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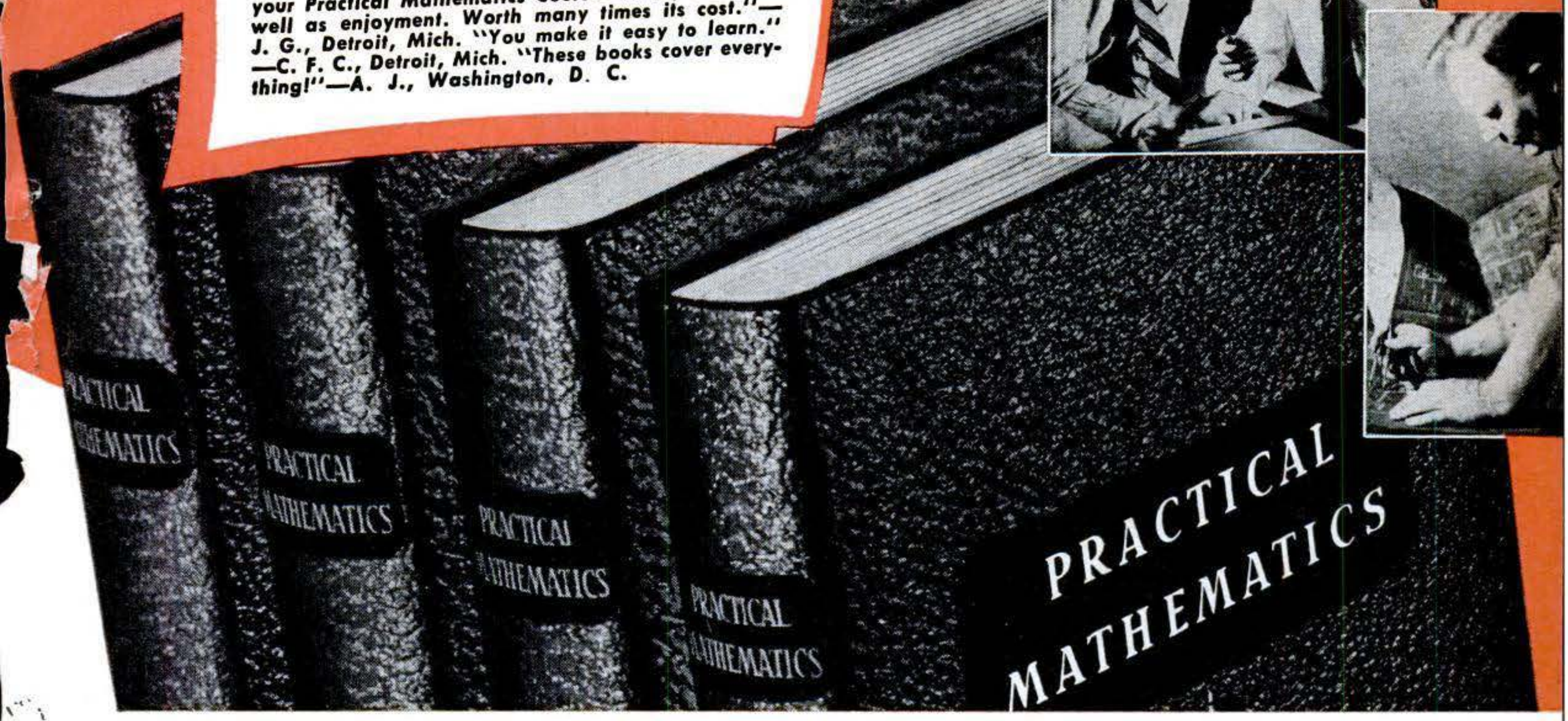

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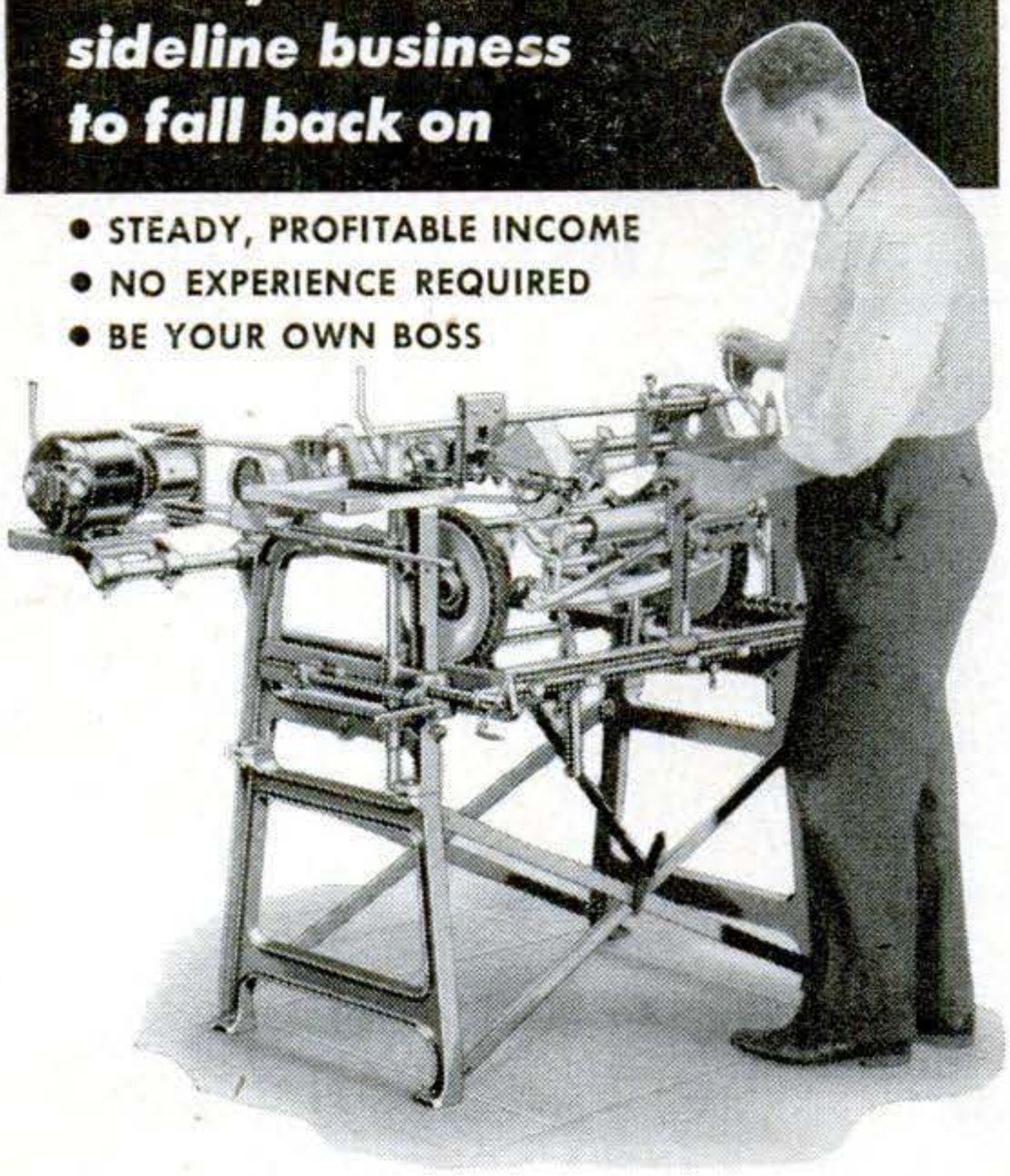

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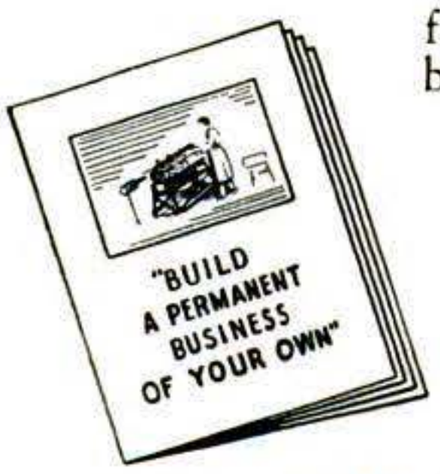

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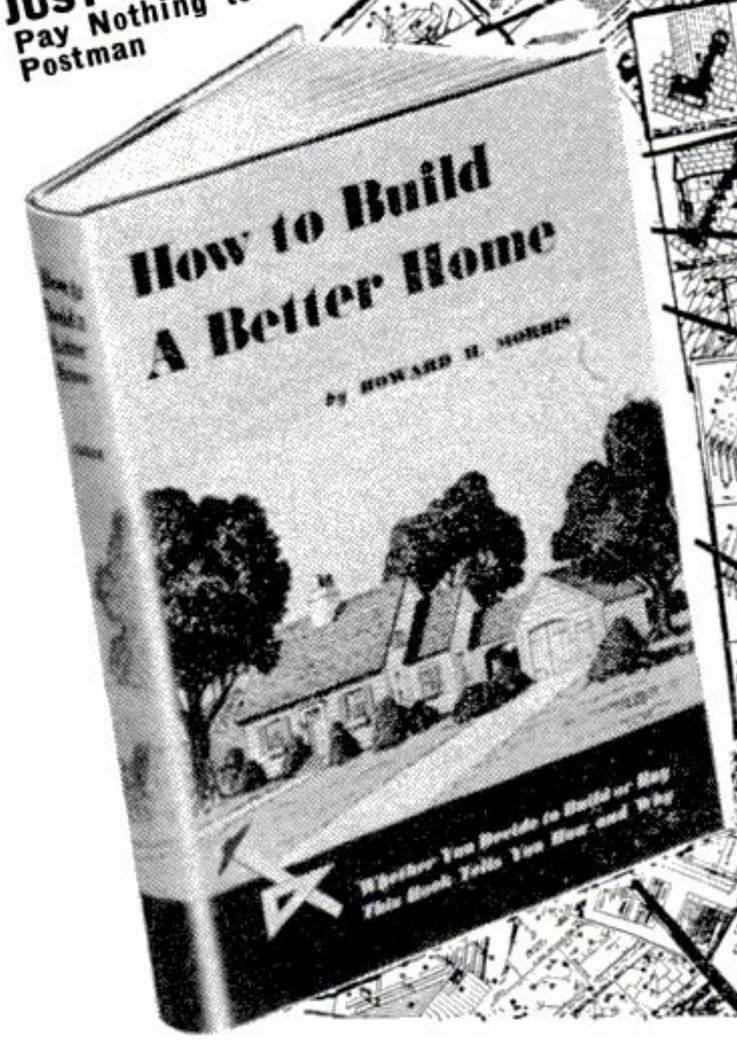

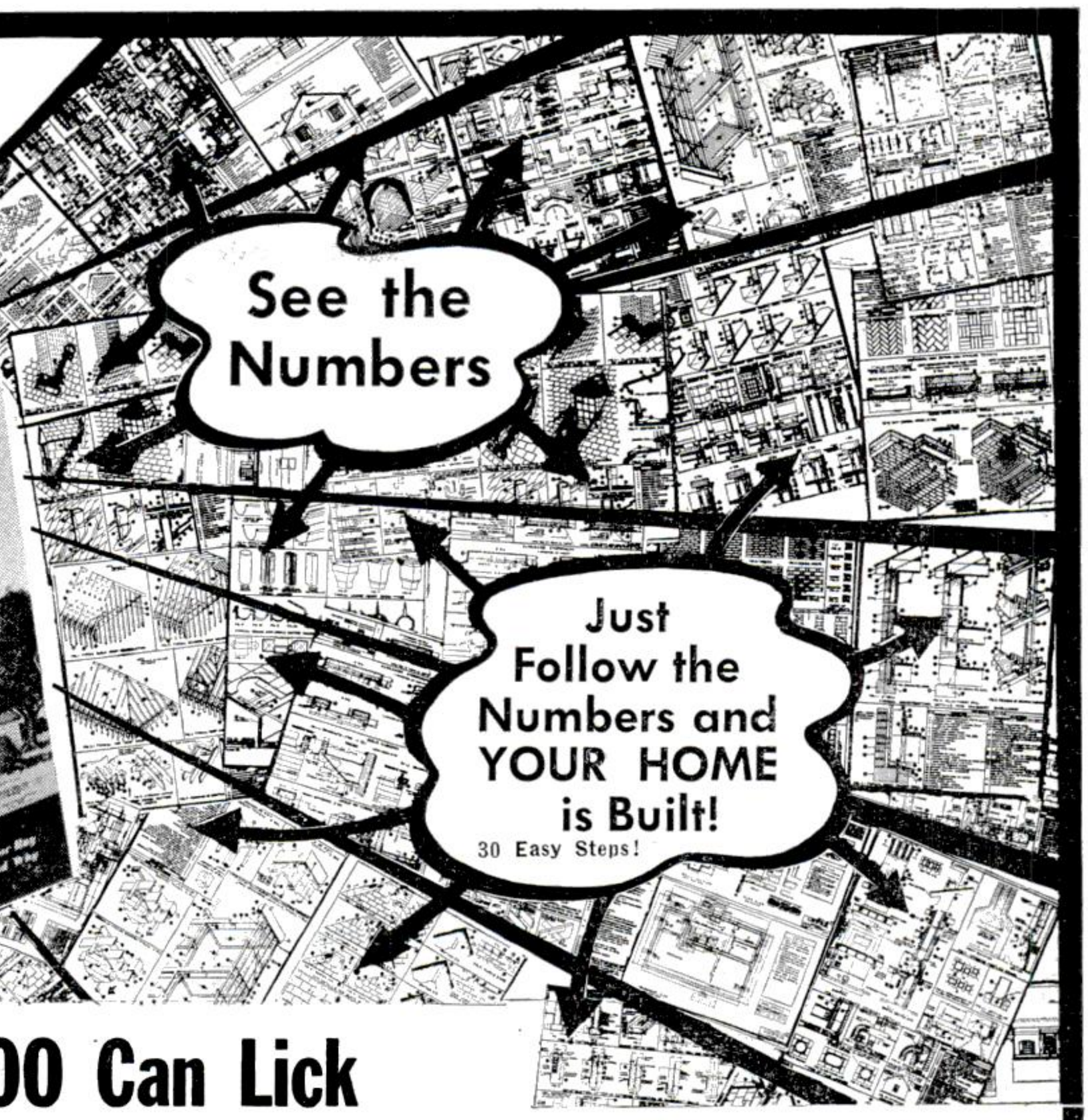

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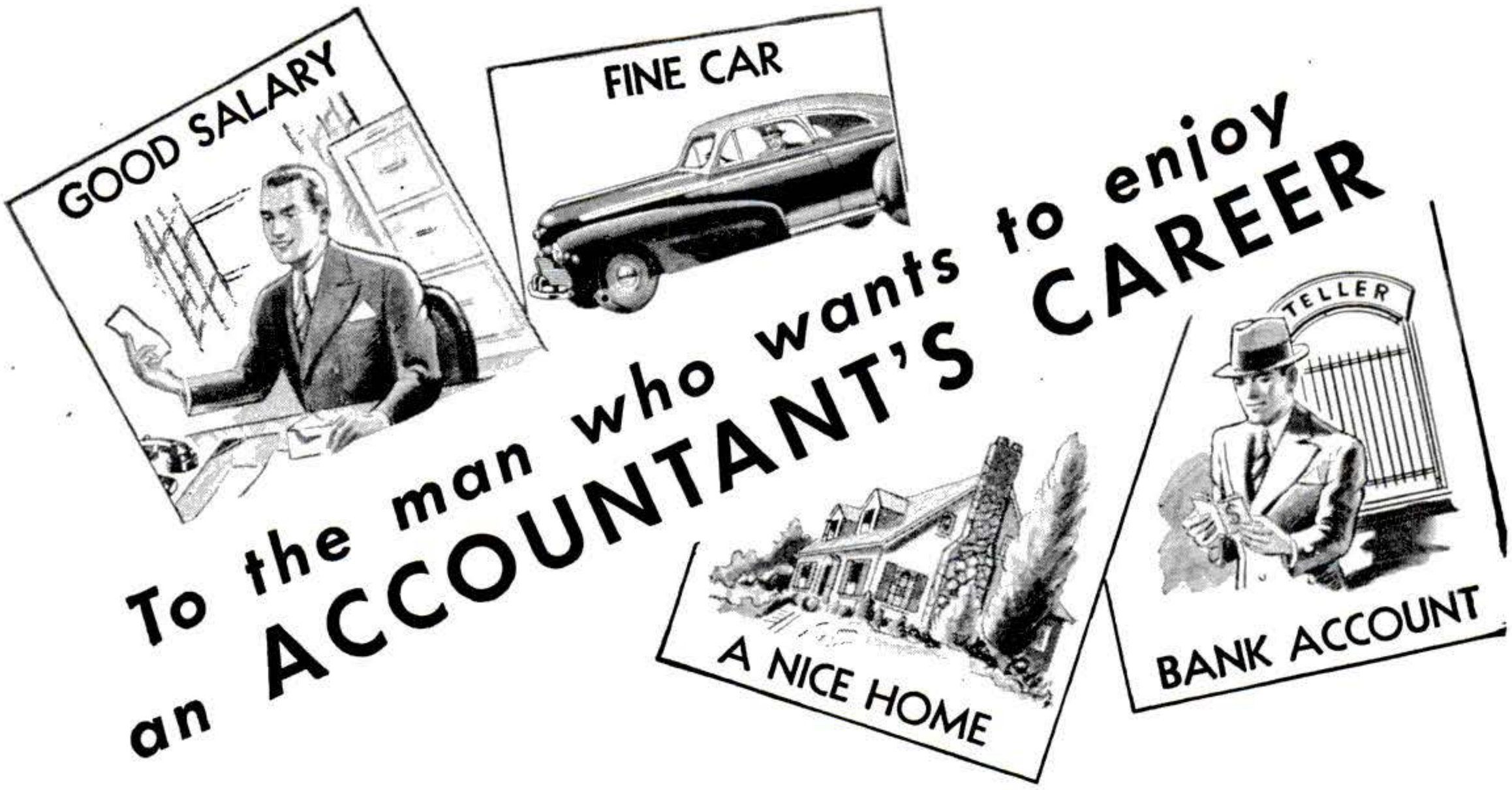

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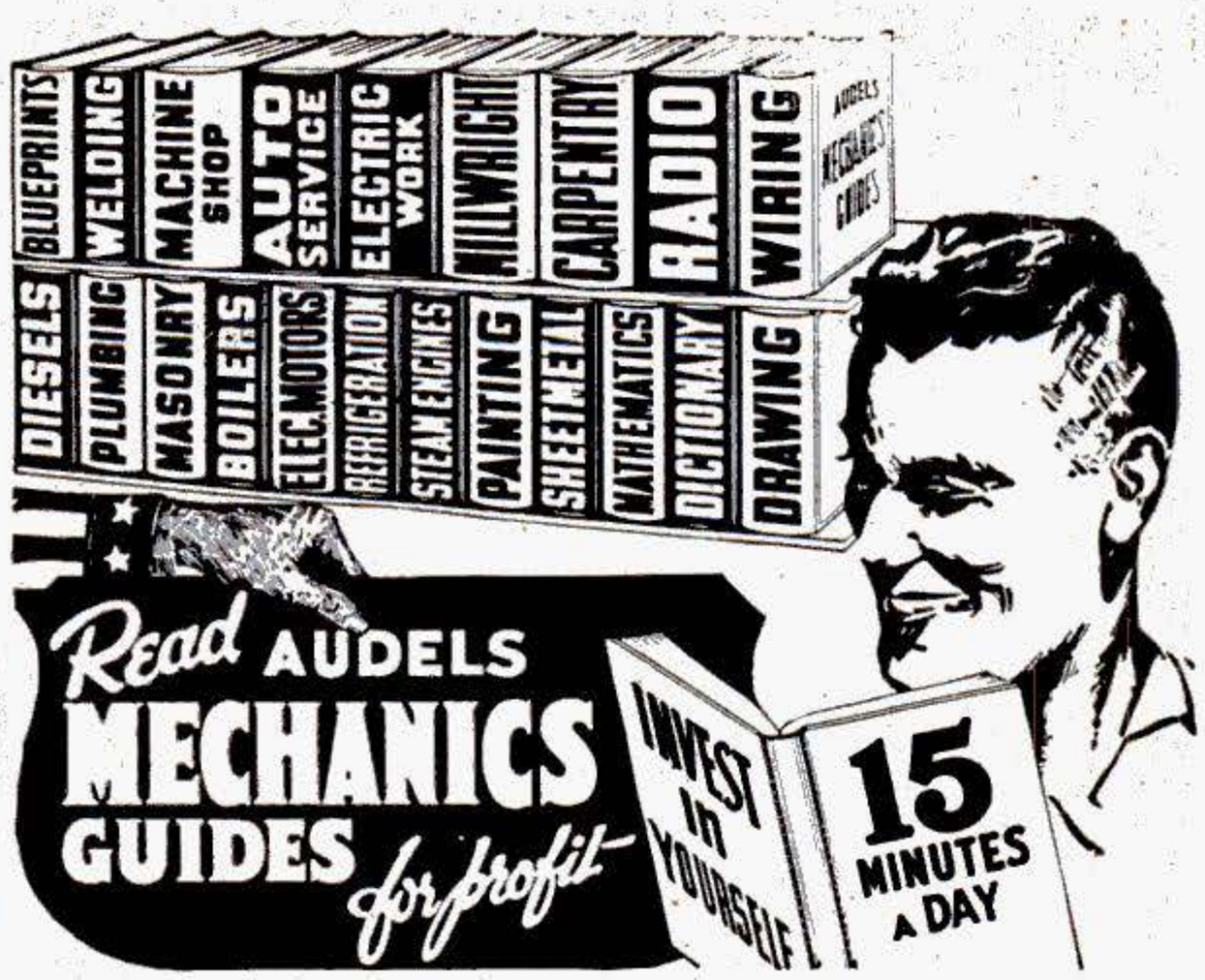

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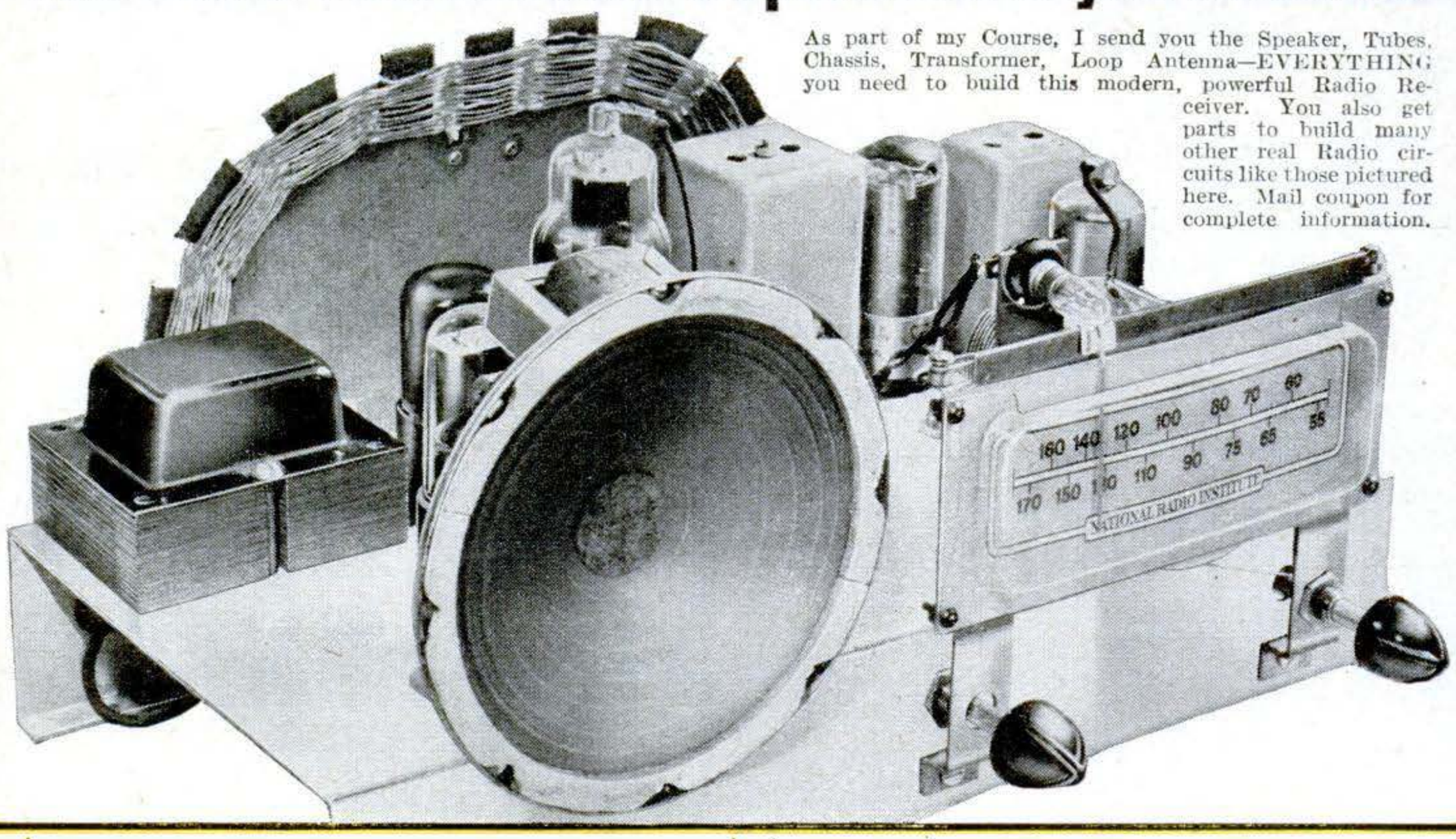

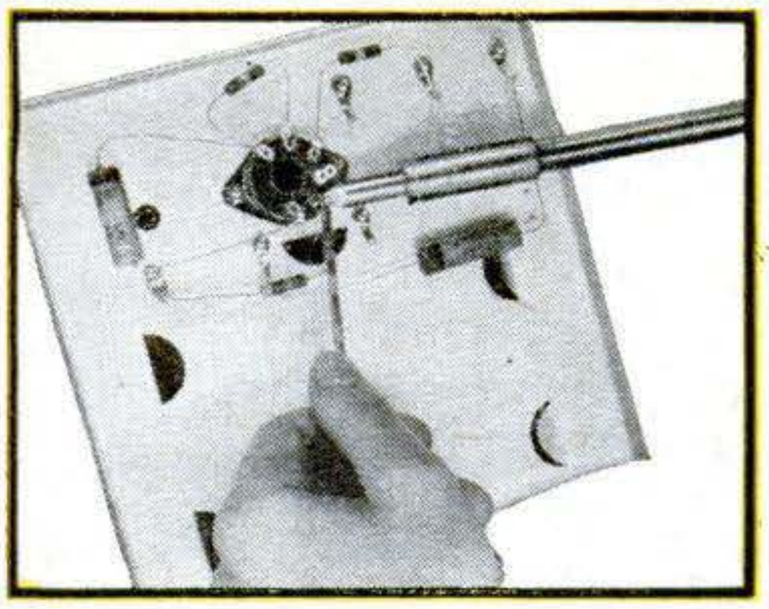

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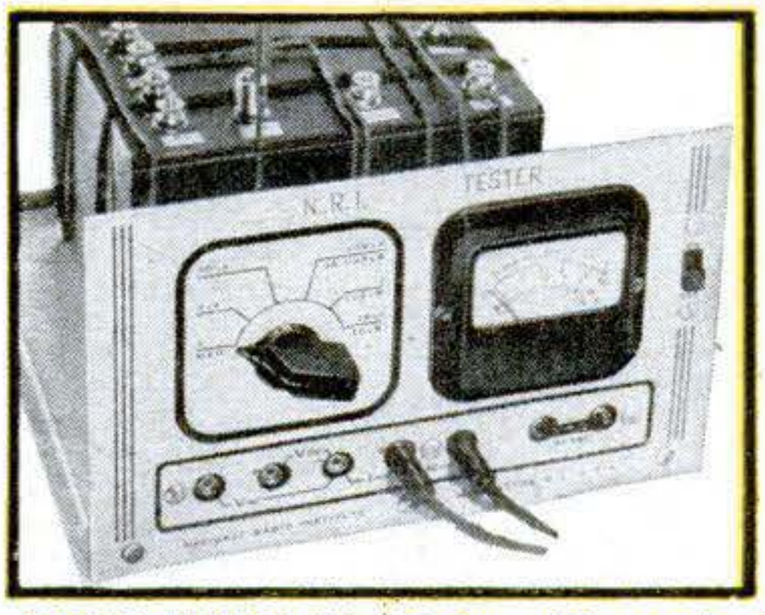

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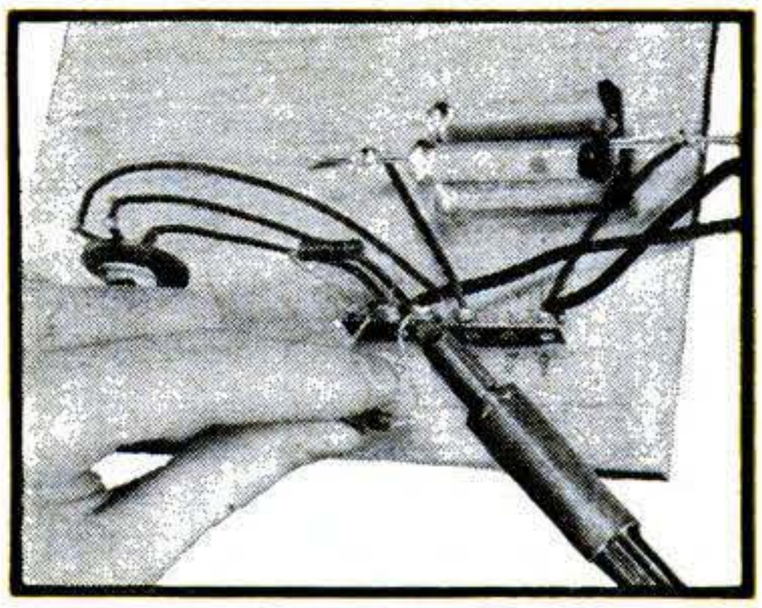

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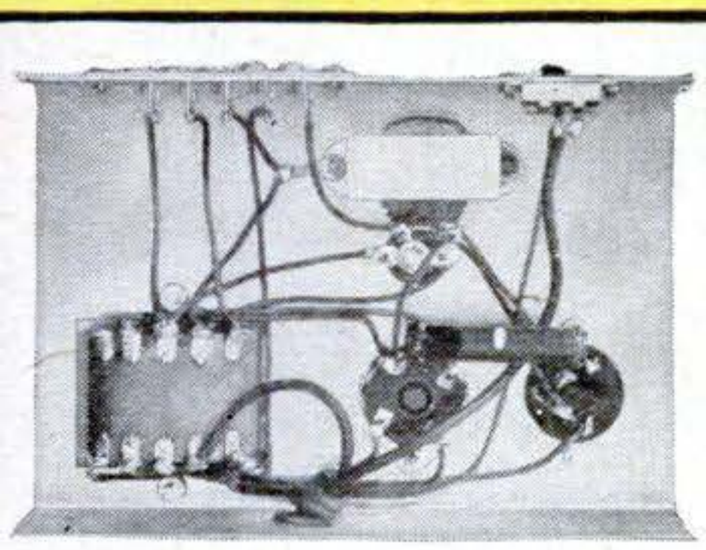

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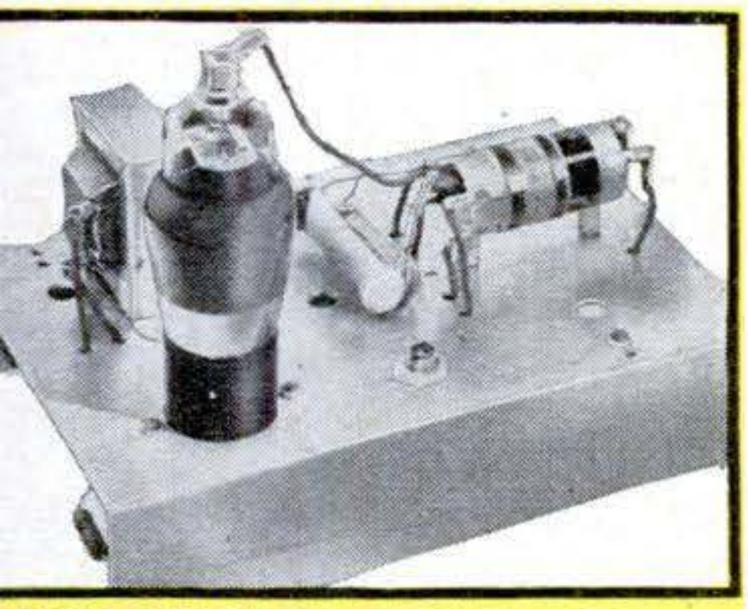

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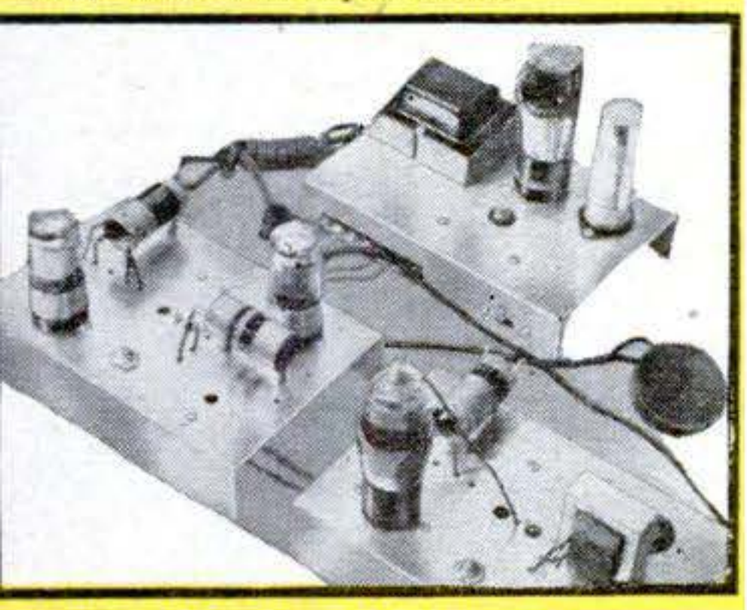

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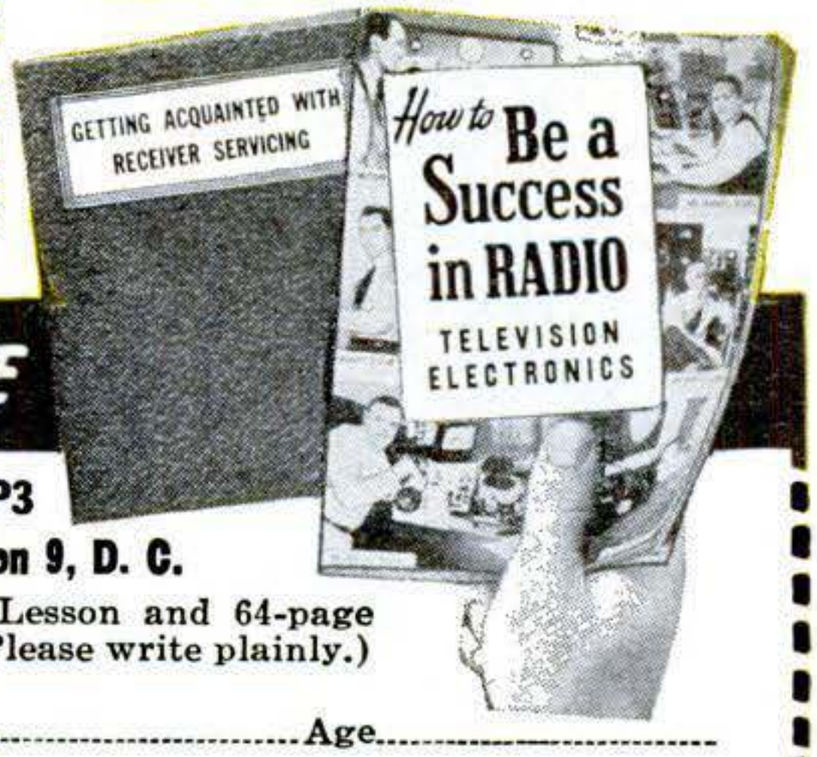

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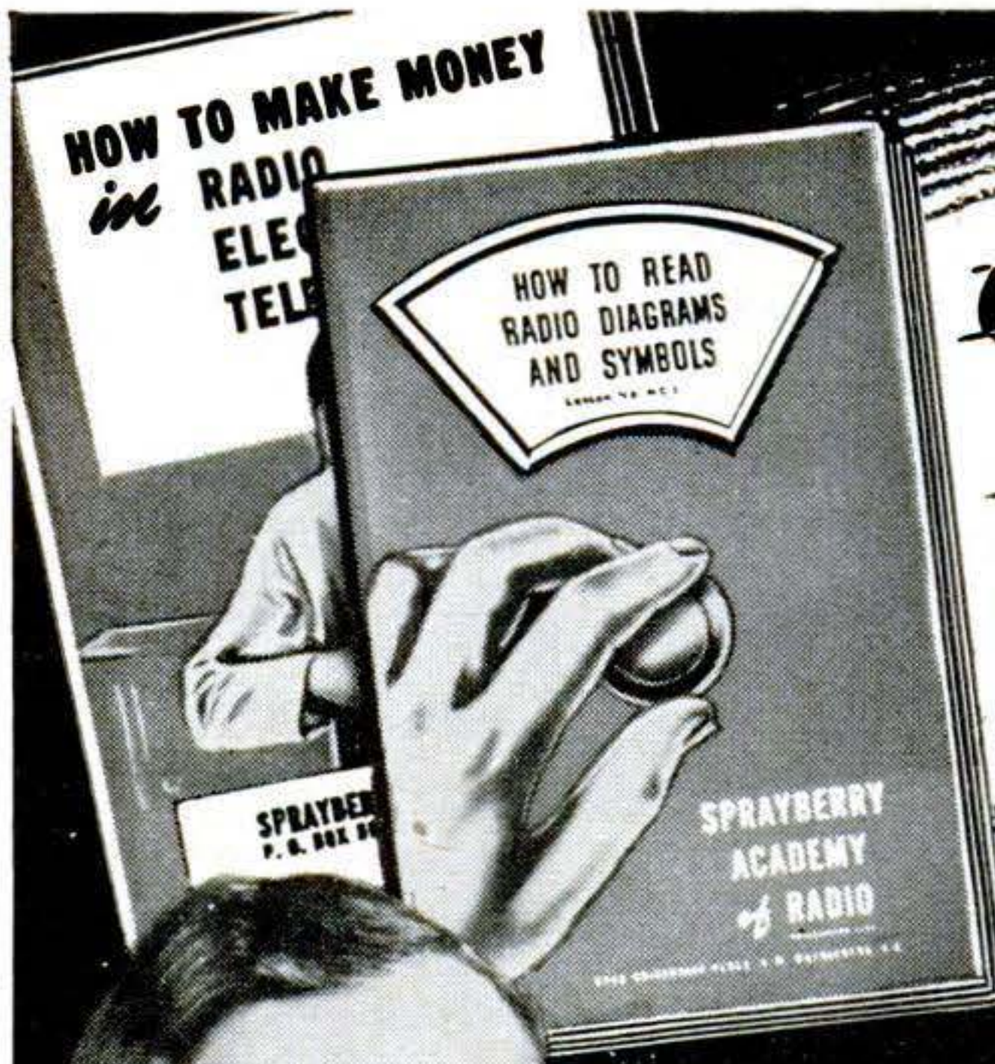

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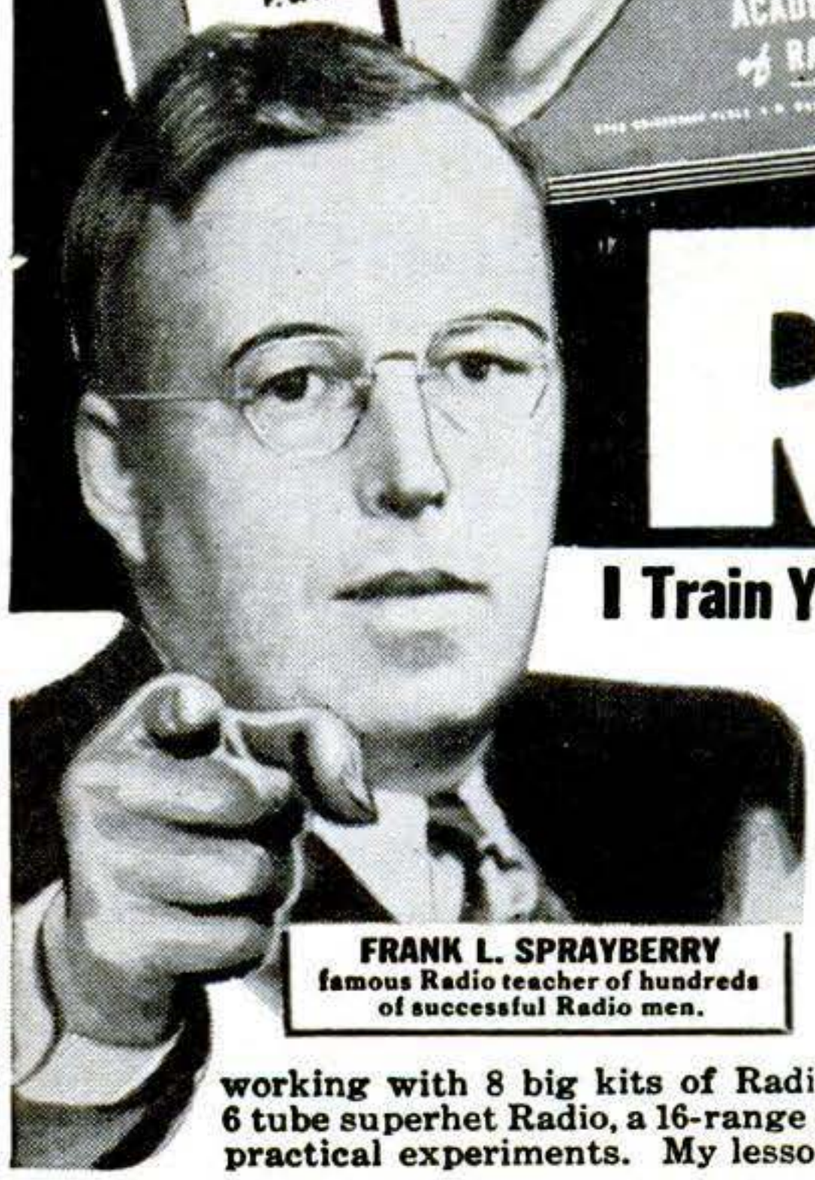

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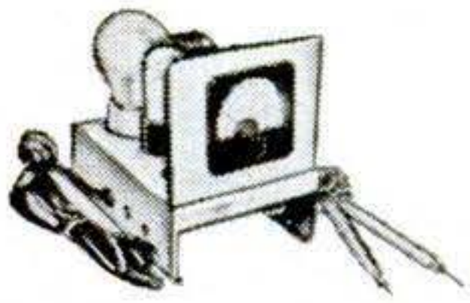

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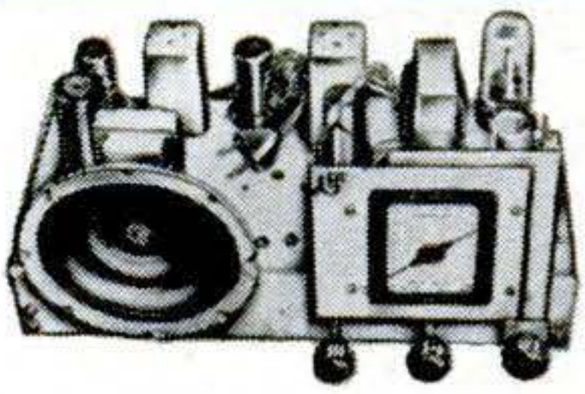

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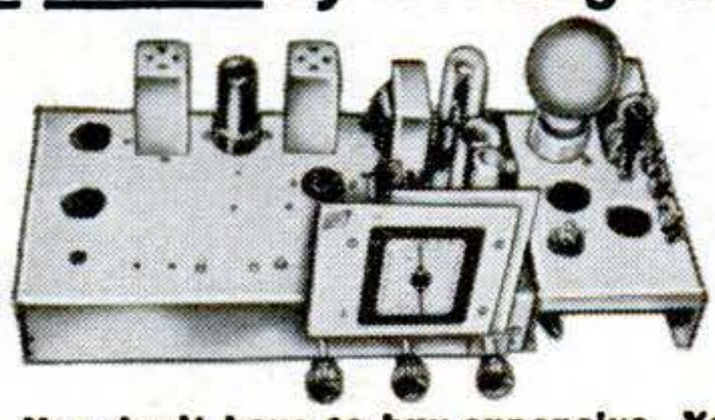
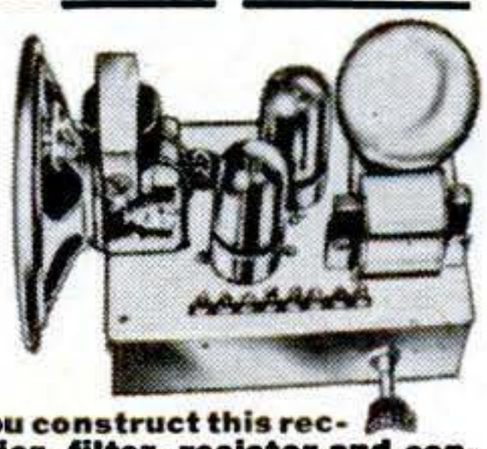


You don't have to buy expensive ready-made equipment. You get valuable experience building this Signal Generator and Multi-purpose Tester.



You construct this rectifier, filter, resistor and condenser tester, and really get on the Practical end of Radio.

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Letters

New Look—But an Old Idea

Sir:

I have just finished reading the article on the 1949 Buick in the December issue (p. 106). I am still wondering what those holes in the sides of the fenders are for.

FRANCIS X. HALLIGAN, JR.
Ashtabula, O.

Although new this year on Buick, these circular openings, called Ventiports®, do the same job as the vertical louvers once found in the sides of virtually all auto hoods. They carry off engine heat and fumes, providing greater riding comfort during long drives in hot weather.

Seeing Is Believing

Sir:

A picture on page 243 of your November issue shows a 2,400-horsepower Cooper-Bessemer gas engine, whereas the caption underneath describes it as a 24,000-horsepower gasoline engine. . . .

E. R. BONNIST
The Cooper-Bessemer Corp.
Mt. Vernon, O.

Our caption writer apparently doesn't believe in signs, for, as the one in the picture clearly states, the engine is a 2,400-hp. gas engine. PS will take a closer look at its pictures from now on—to keep up with the score of PS readers that caught this one.

Bathing Dog Viewed Askance

Sir:

In the September issue on page 134, captioned "New Ideas from the Inventors," you have a cut depicting the very last word in nonsensical inventions. Rube Goldberg, at his zaniest, never dreamed up anything to equal this. This device is titled "Bathing Harness Holds Dogs."

On viewing this aid to harried dog bathers, my first reaction is: who is holding the inventor? Someone certainly should be —the guy is apt to get violent at any minute. Another thought occurs: who helps

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If an inventor believes he has an invention, a search of the most pertinent prior U. S. patents should be made and a report obtained relative to its patentability. Where such report indicates that the invention appears patentable, in order to secure protection, diligence should be exercised in making application for a patent.

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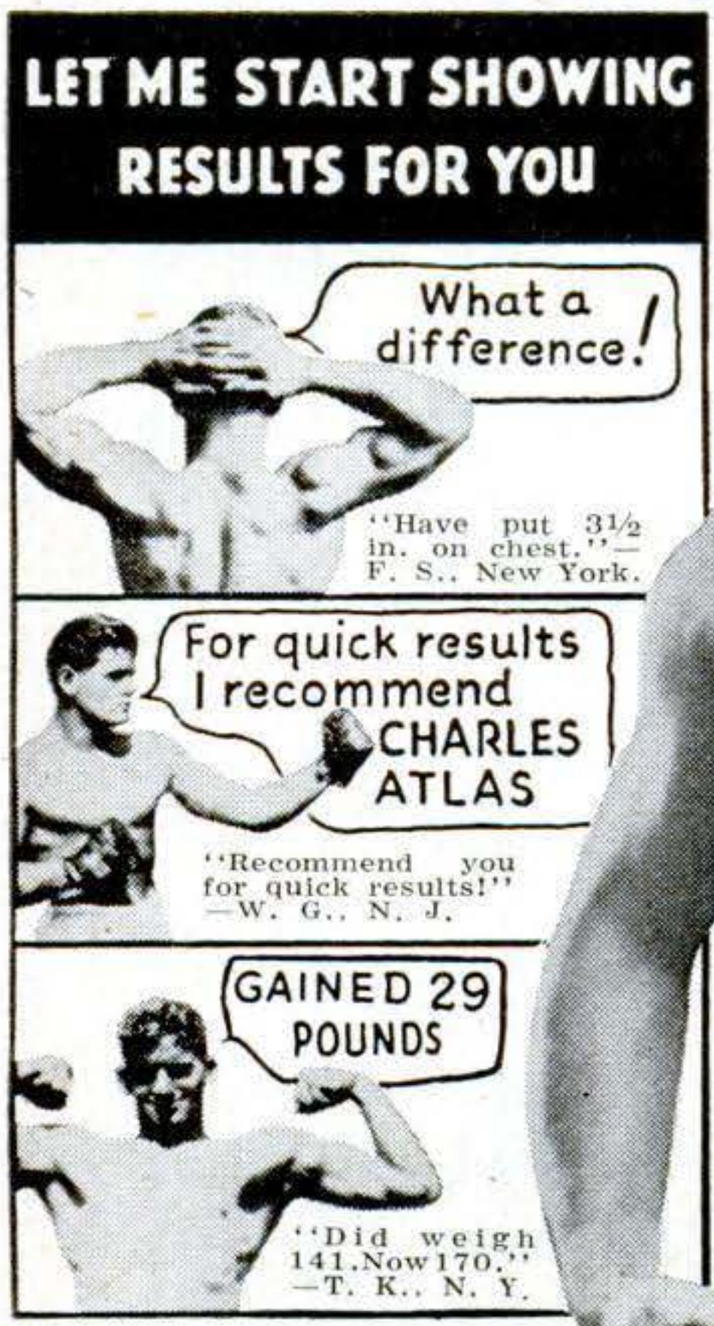

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the dog bather in putting the darn thing on the dog and what is the poor pooch doing in the interim . . . ?

What happens if you own a St. Bernard?

E. B. HARRIS

San Diego, Calif.

Have him dry-cleaned.

New Clutch Needs No Pampering

Sir:

Your article in the June issue (p. 83) covering the Electromagnetic Fluid Clutch has aroused my curiosity as to what type of seal would effectively retain the iron-oil mixture in the clutch housing. It seems to me that the abrasive action of the iron-oil mixture would rapidly cut out any of the conventional-type oil seals. . . .

C. L. CULBERTSON

Kellyville, Okla.

The abrasive action of the iron particles is negligible since they are spherical and range in size from one-half to 10 microns in diameter. (A micron is 1/1,000 of a millimeter.) Several types of conventional oil seals will work satisfactorily: the ordinary rubber doughnut or O-ring, multiple-lip rubber seals, or the same type used in present fluid-drive transmissions.

Canned Television?

Sir:

In the "Letters" column in the November issue of POPULAR SCIENCE, one reader mentions his idea of putting television on records to provide "canned television."

I am not positive of the upper frequency limit of recording disks, but believe it is in the neighborhood of 10,000 to 12,000 cycles per second maximum. The carrier frequencies necessary to handle television video are well over 100 megacycles, or 100,000,000 cycles per second. Obviously, this frequency could not be impressed on a disk. . . .

R. W. SPRADLING

Pittsburgh, Pa.

Sir:

. . . Utter nonsense, if you please! Some twenty years ago a process was put into public use which seems to fill the bill. I refer, of course, to the synchronization of sound with a well-known technique for the recording of visual images. In other

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*U*nless an inventor is thoroughly familiar with such matters, he is advised to employ a competent registered patent attorney, as the value of patents depends largely upon the skillful preparation of the specification and claims.

*W*e recommend that you authorize us to conduct a search through the United States patents pertinent to your invention and to submit a report setting forth our opinion with respect to its patentability.

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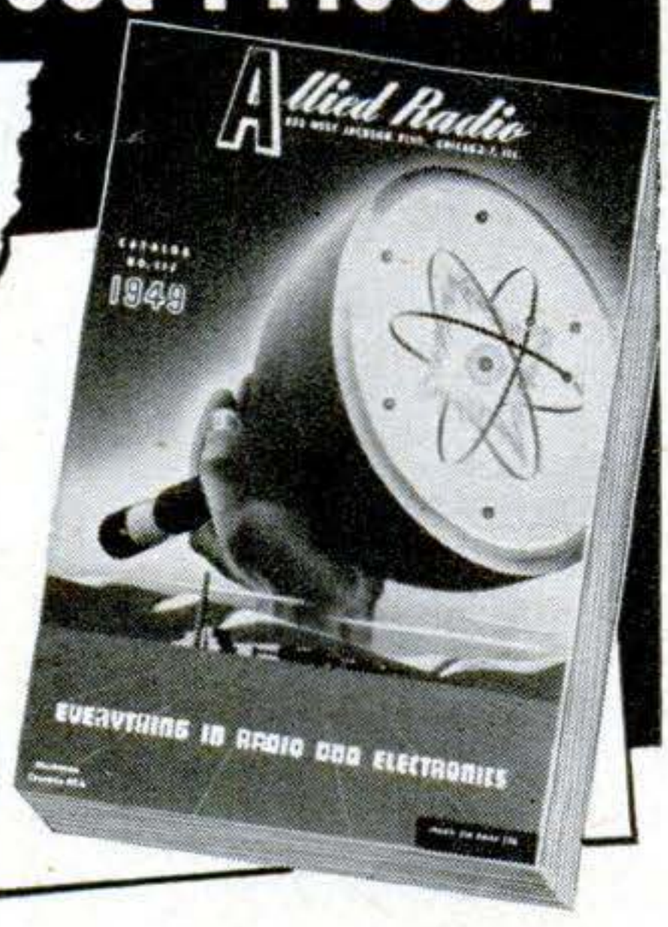

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words, have you not yet heard of talking pictures?

ROBERT E. WHALLON

Troy, N. Y.

You're both wrong. Canning television is neither as simple as Mr. Whallon states, nor as far-fetched as Mr. Spradling believes. The problem is not one of sound and image synchronization, which would be relatively easy, but of finding a recording medium with the frequency range television requires. PS did not say that such a system is now possible but simply that it may not be impossible, since the method involved would be basically similar to the recording and playback of facsimile images, already accomplished at lower frequencies.

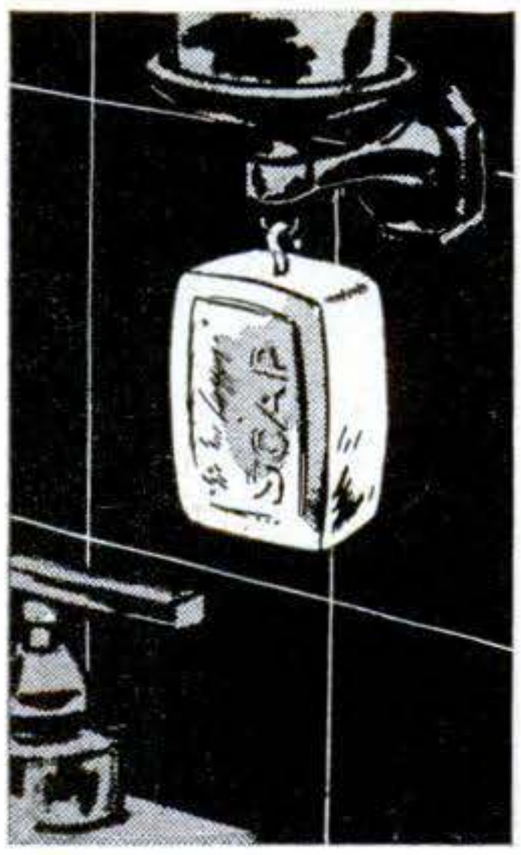
No Soft Soap

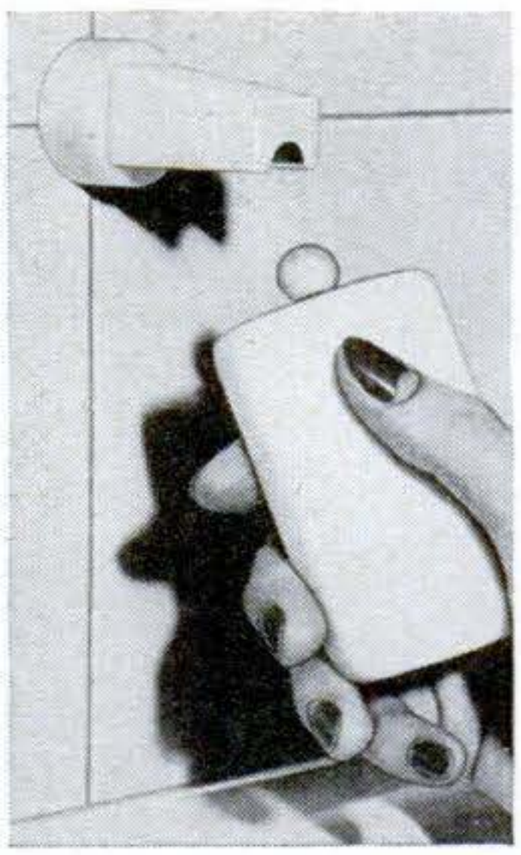
Sir:

In "I'd Like to See Them Make" (PS, Sept. '48, p. 107), Anthony Pozzuoli asked for a hang-up hook for soap (shown at left below, reprinted from PS, Sept. '48). We think the Edger Magnetic Soap Gripper (at right), just out, is a scientific solution of this slippery problem. A permanent Alnico magnet in the wall-piece holds a ball-crowned stem pressed into the bar of soap.

UREY W. EDGER

Louisville, Ky.





Round-Robin Error

Sir:

It's funny how an error, once started, keeps on rollin' along. Your picture of molecules on page 155 of the December issue appeared some two months before in *Science News Letter* with the same descrip-

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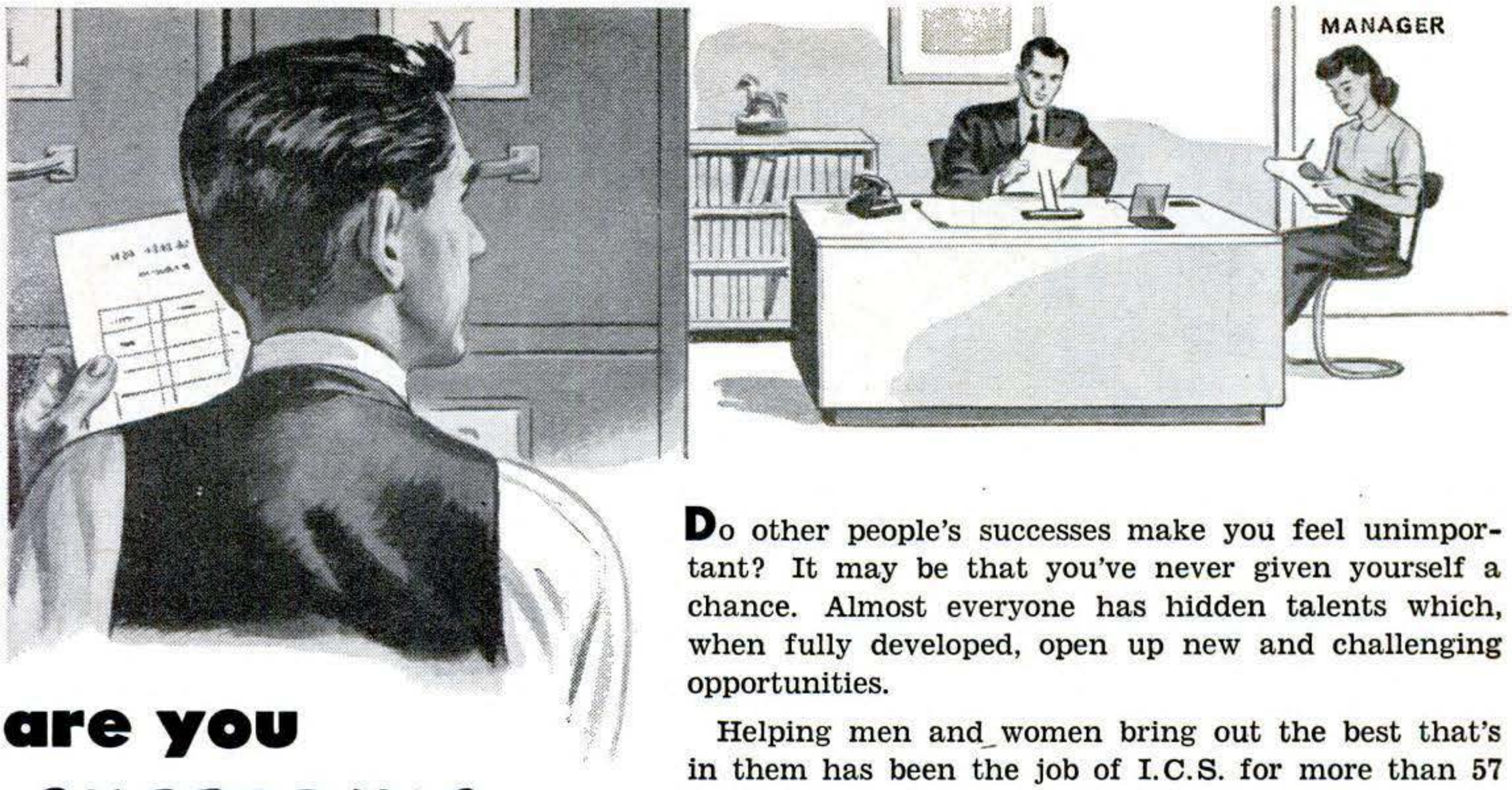

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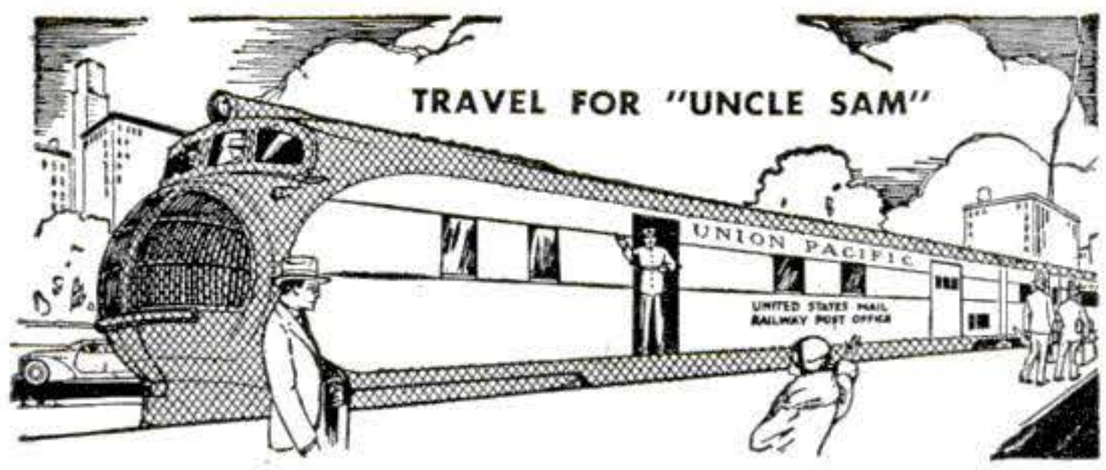

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tion below it and the same silly error: "The smallest bit of matter ever photographed, each molecule is about 4/10,000 in. in diameter."

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CHAS. C. FINN

San Francisco, Calif.

PS got its information—and the error—from an independent news agency.

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Kansas City, Mo.

Alumina Dries the Wind

Sir:

I saw recently a copy of your magazine POPULAR SCIENCE. May I express to you my appreciation of its great potential value in this highly scientific age. I like the exciting approach, the imaginative treatment, the splendid pictures, and the very interesting simplified diagrams.

It is not my habit to write calling attention to errors in scientific writings . . . but, on page 118 of your October issue, in describing North American's wind tunnel, you say silica gel is used to dry the air. . . .

We built the dryers for this very interesting installation. The air is dried by "solid adsorption" but not by the kind of adsorbent you mention—silica gel—but by a definitely different kind, Activated Alumina. . . .

G. L. SIMPSON
Vice-President & General Manager
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At the time the article was written, North American was planning to use the silica gel, as stated. Later, however, it decided to change to Alcoa's Activated Alumina.

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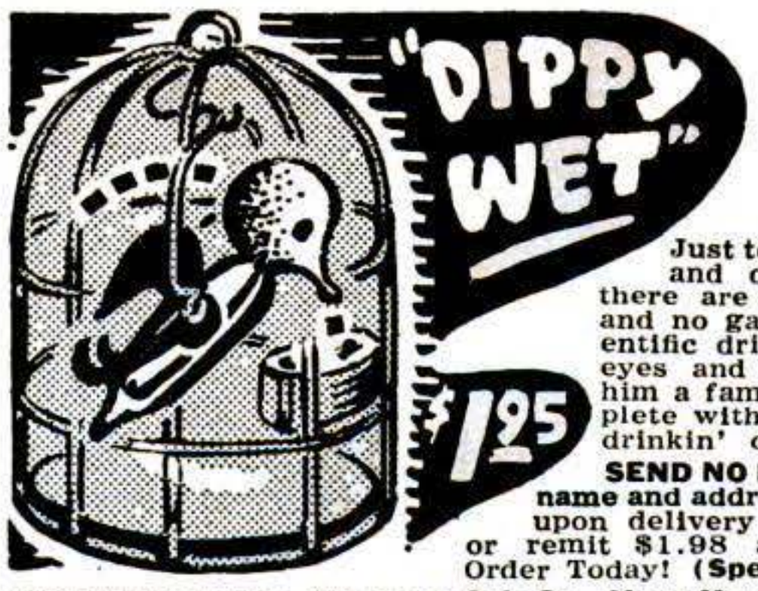

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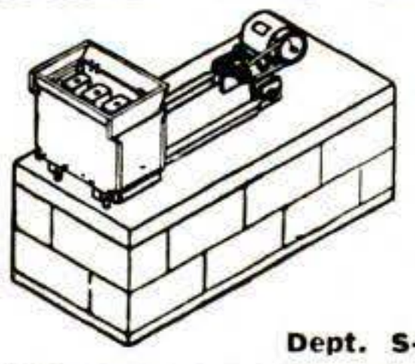

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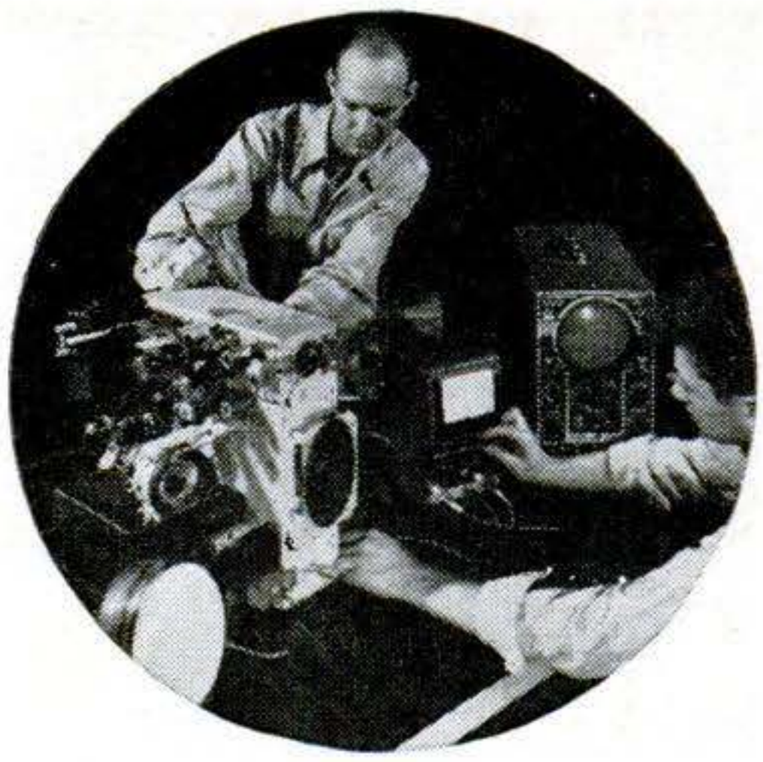

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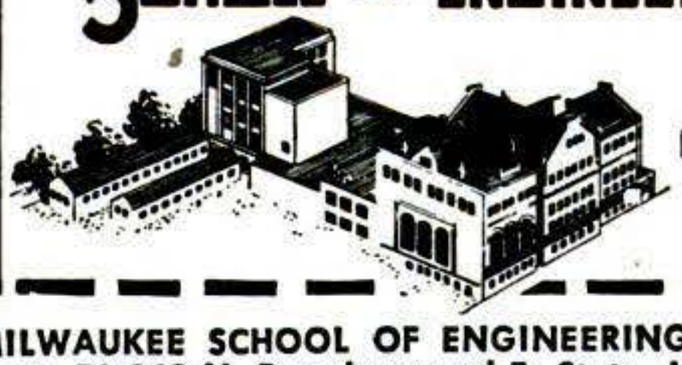

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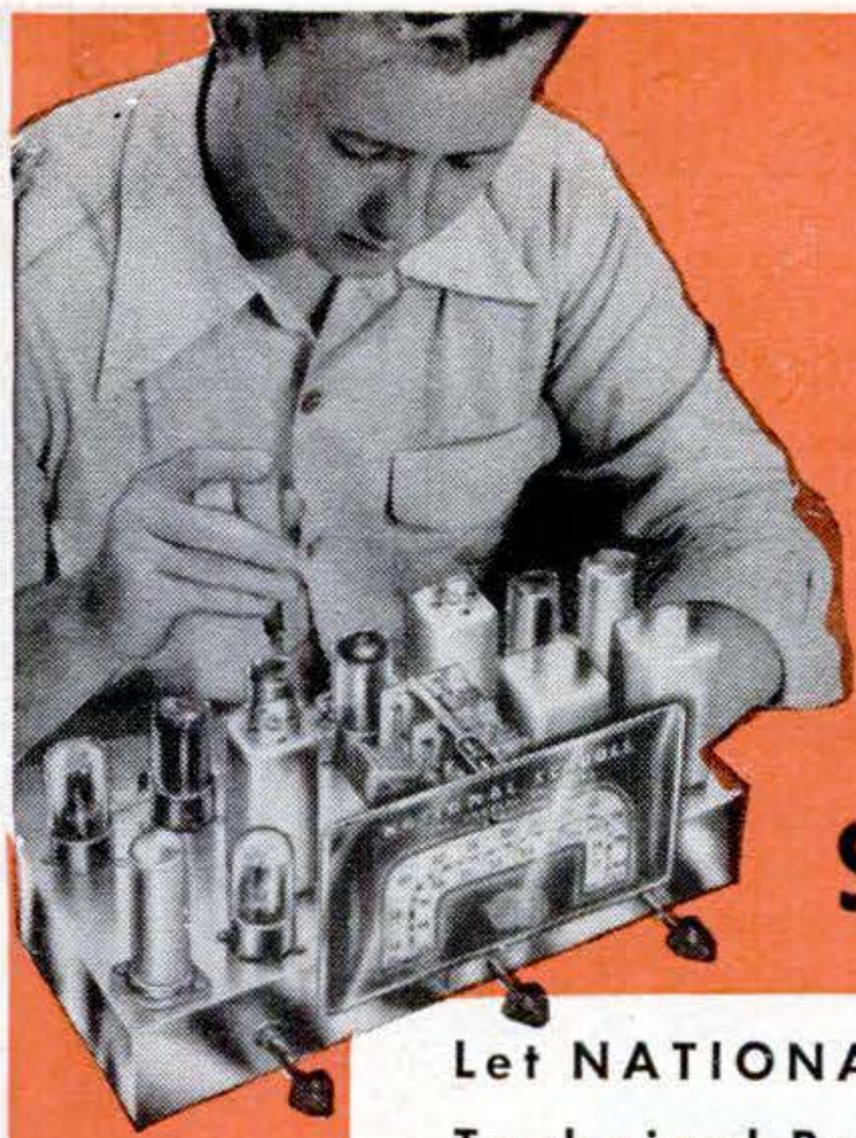

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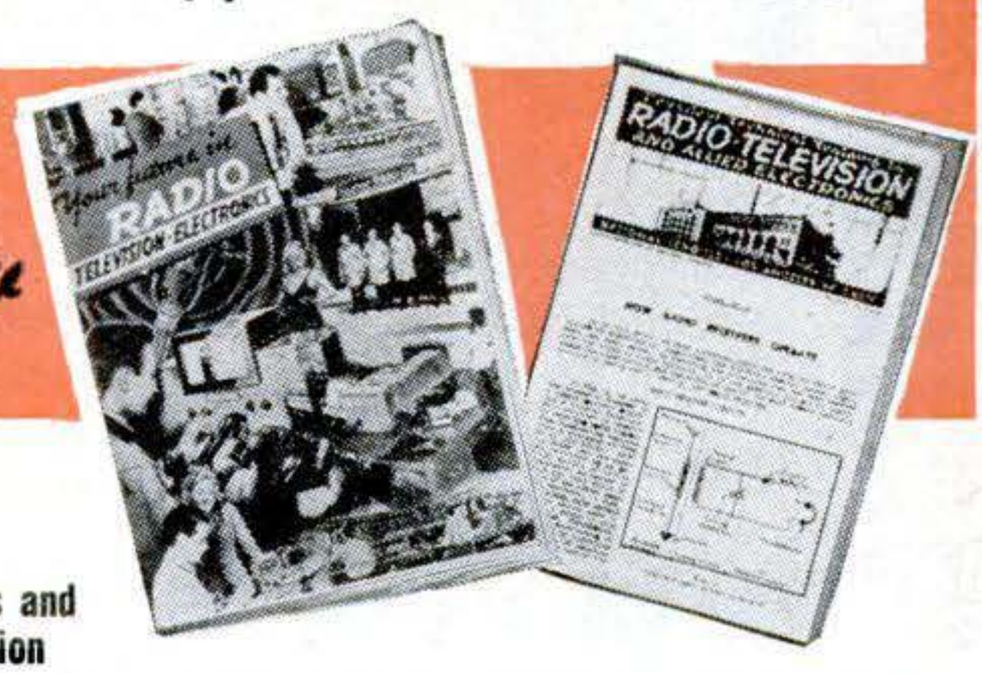

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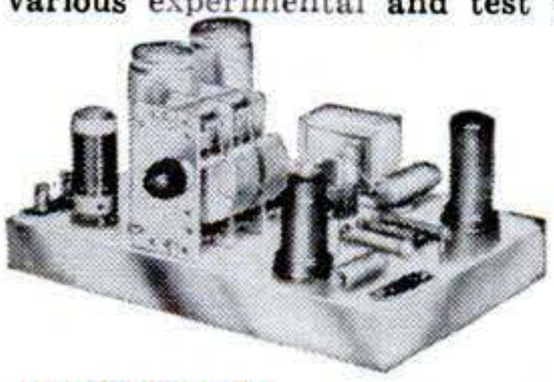

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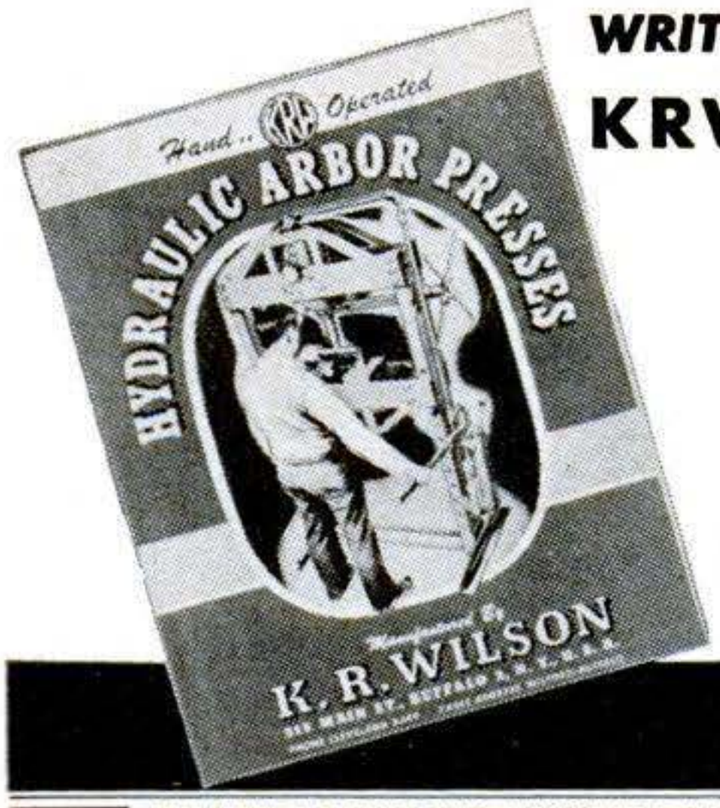

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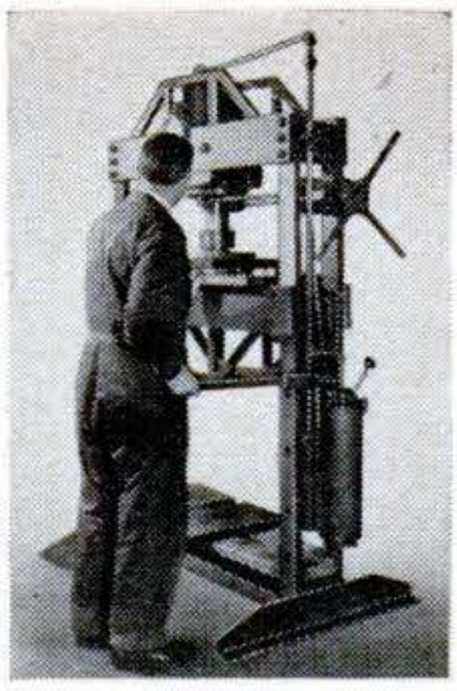

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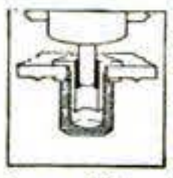

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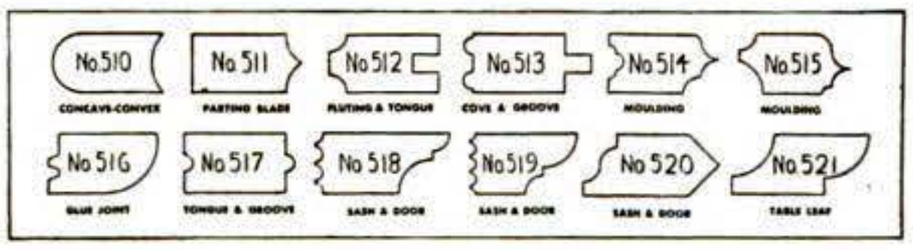

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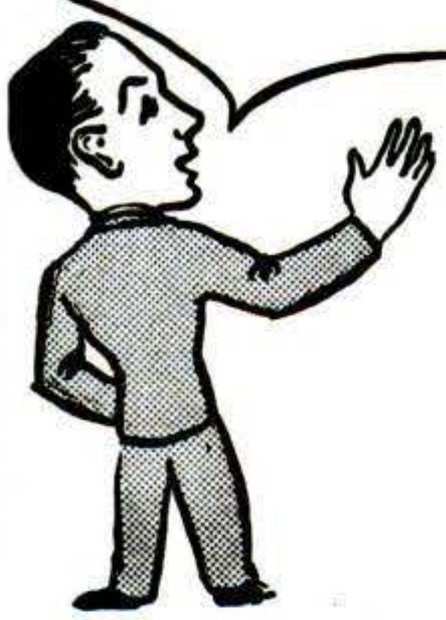

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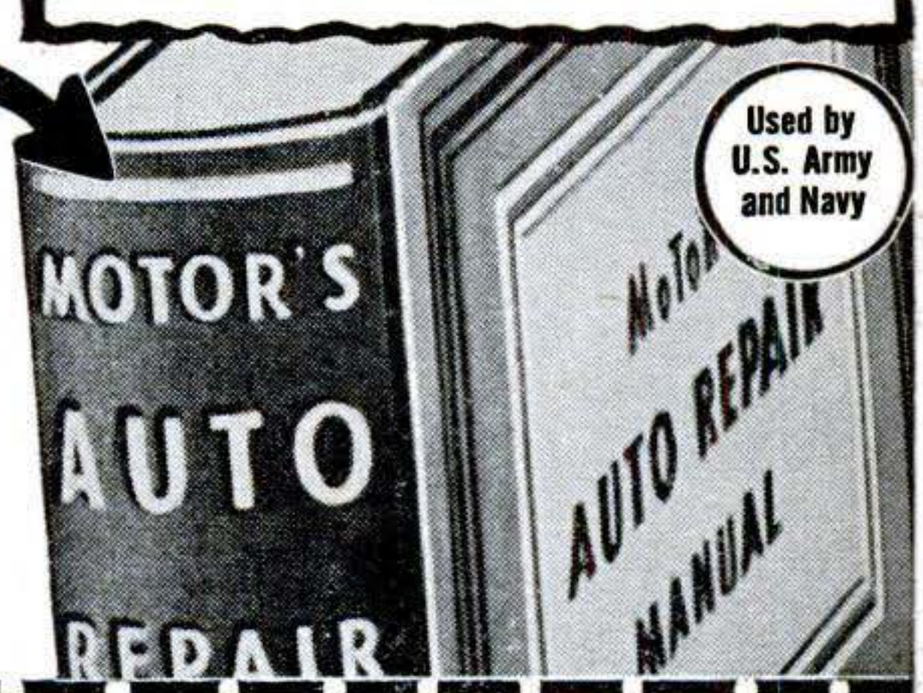

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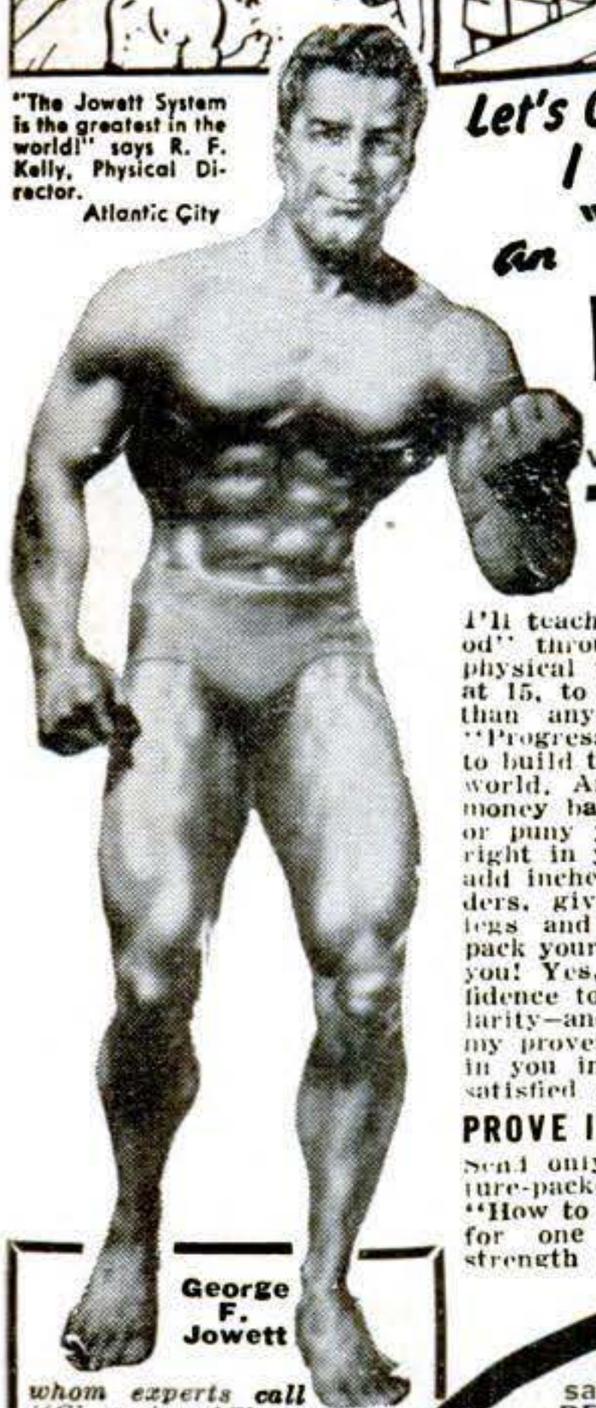

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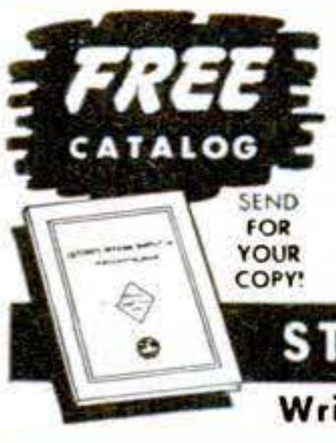

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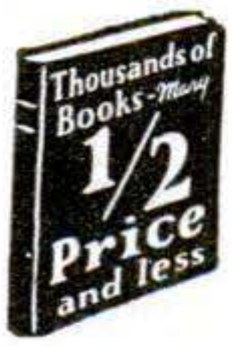

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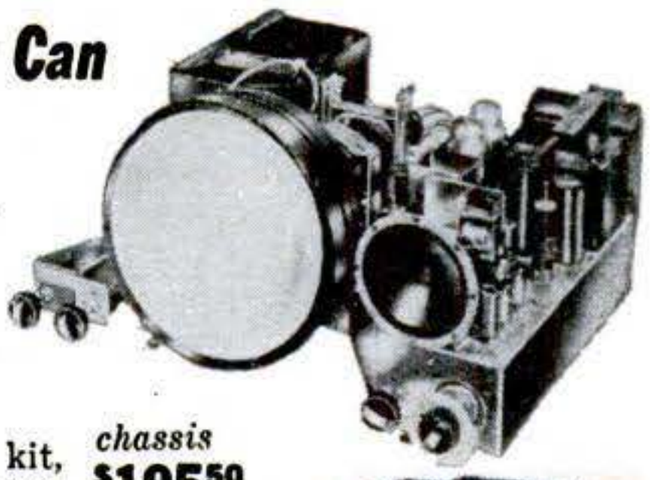

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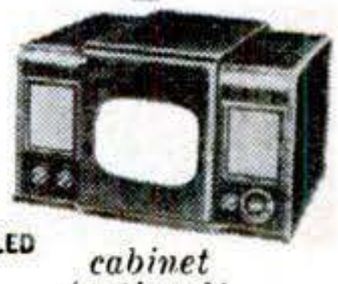

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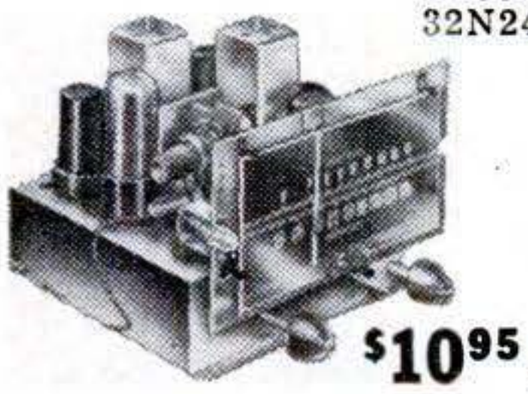

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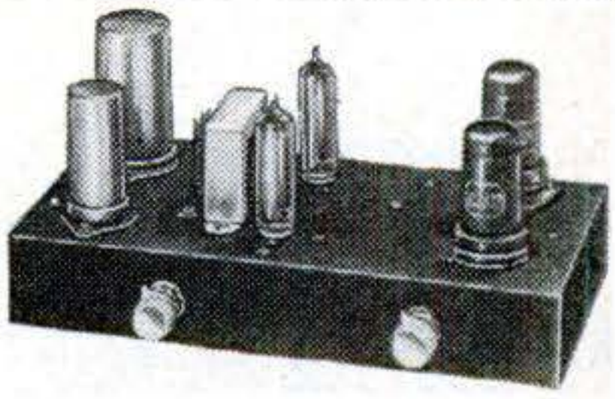

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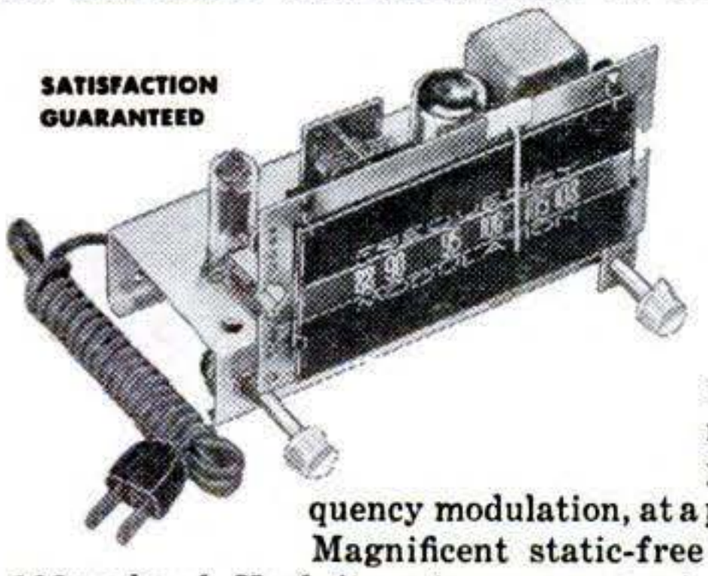

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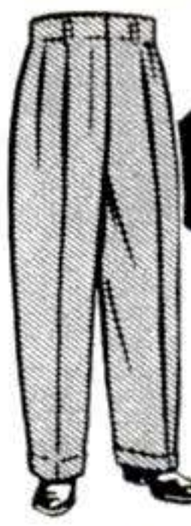

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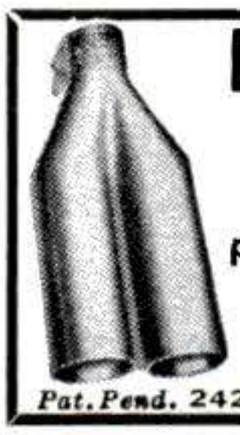

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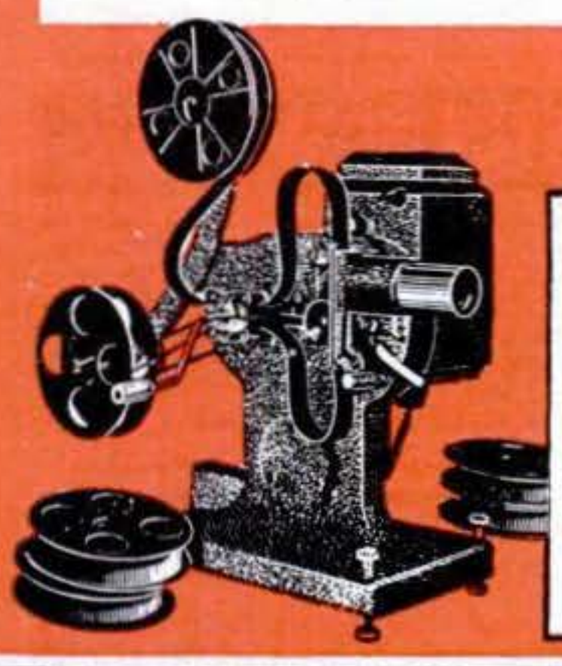

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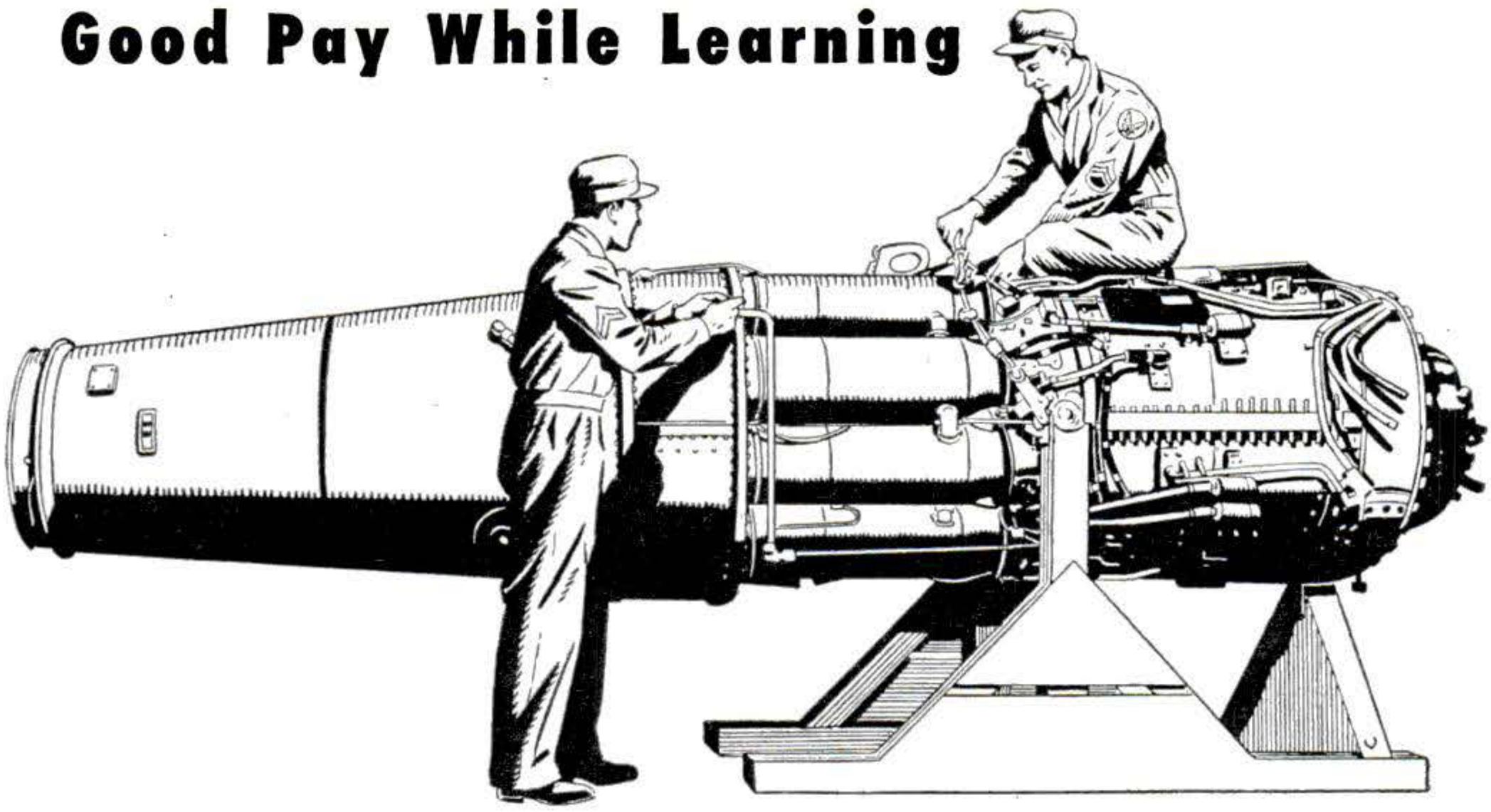

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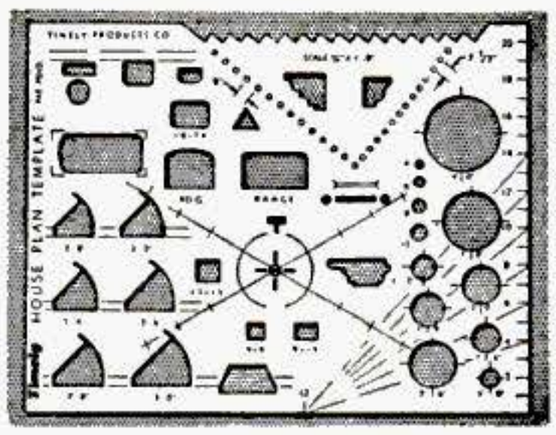

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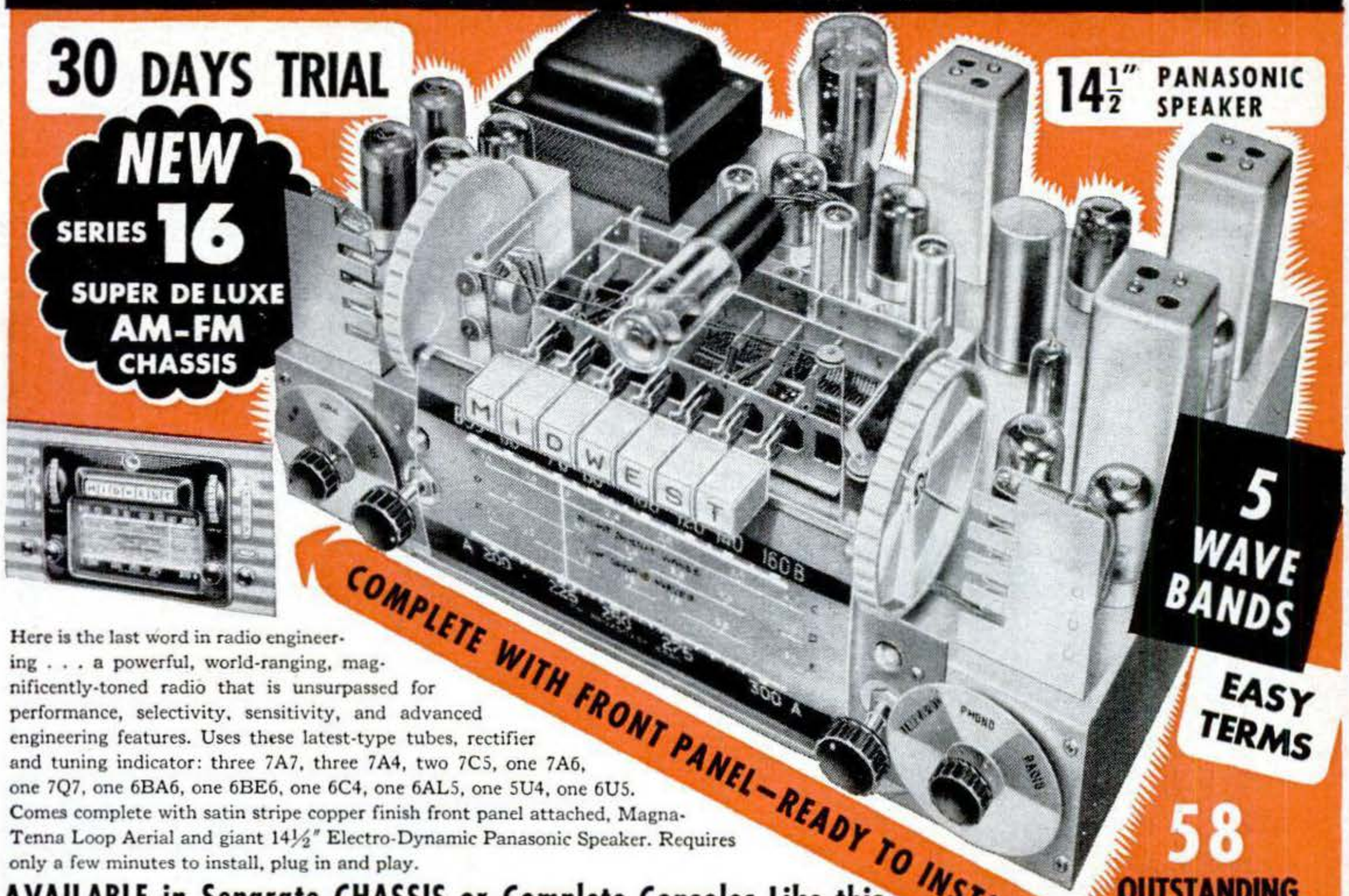

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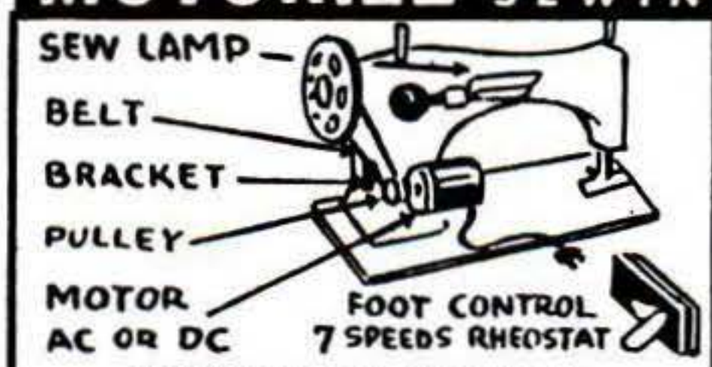

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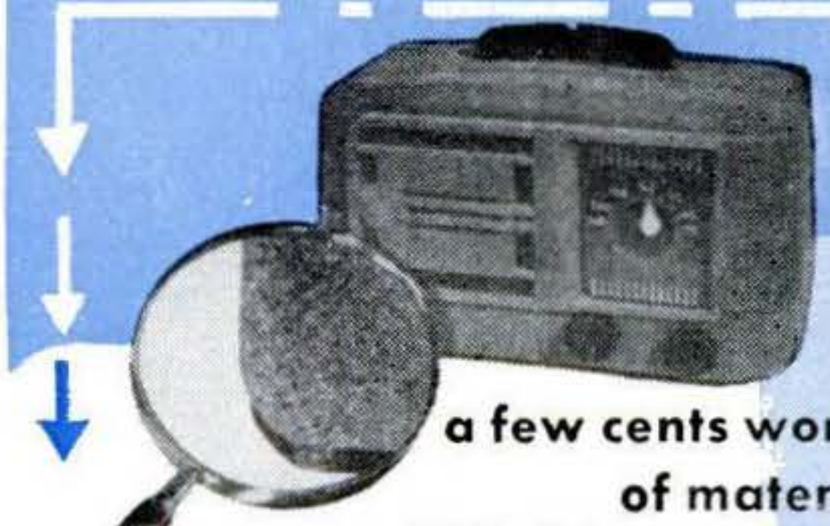

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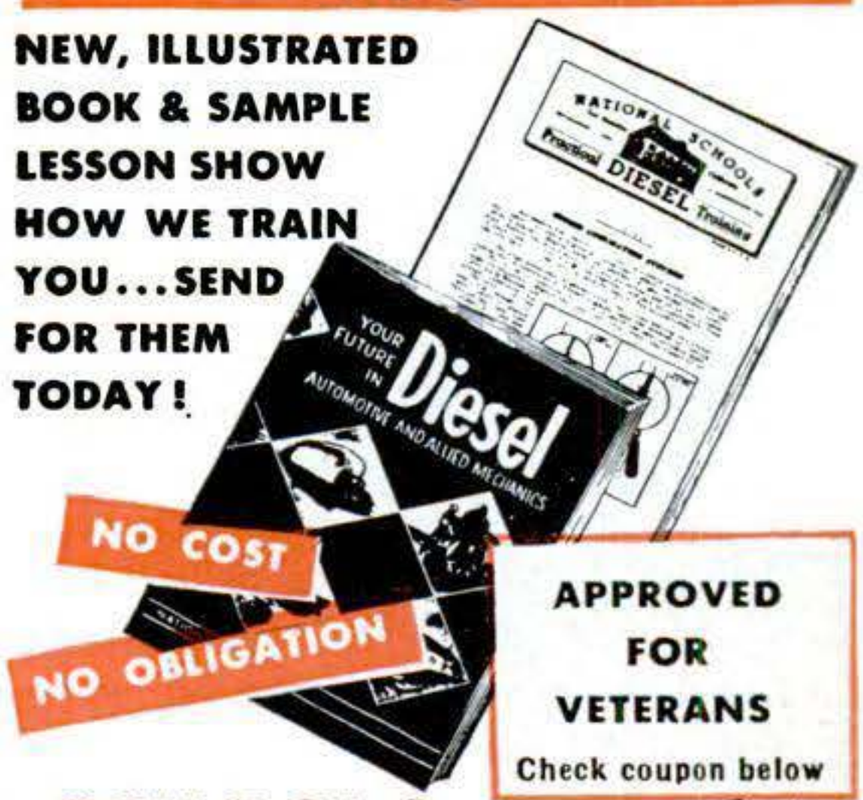

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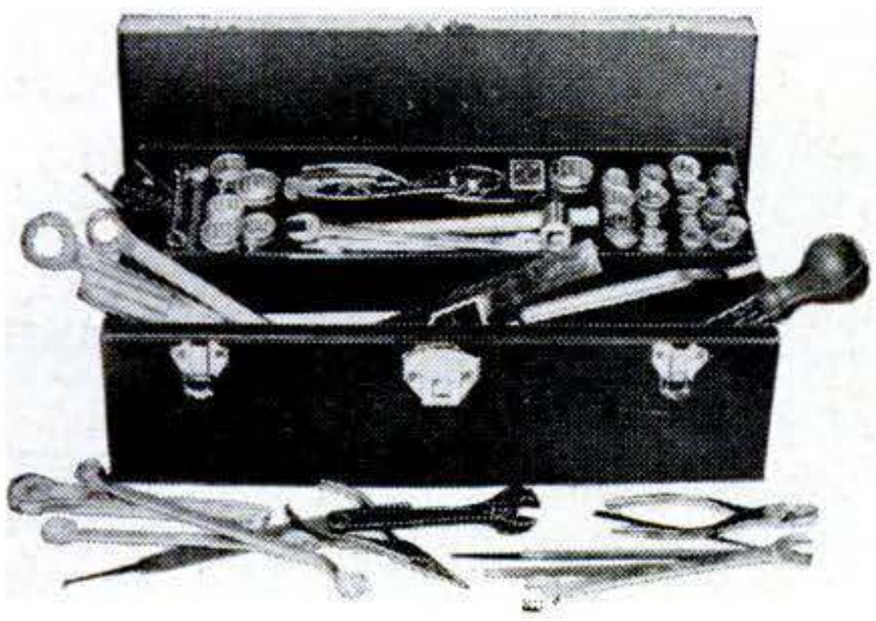

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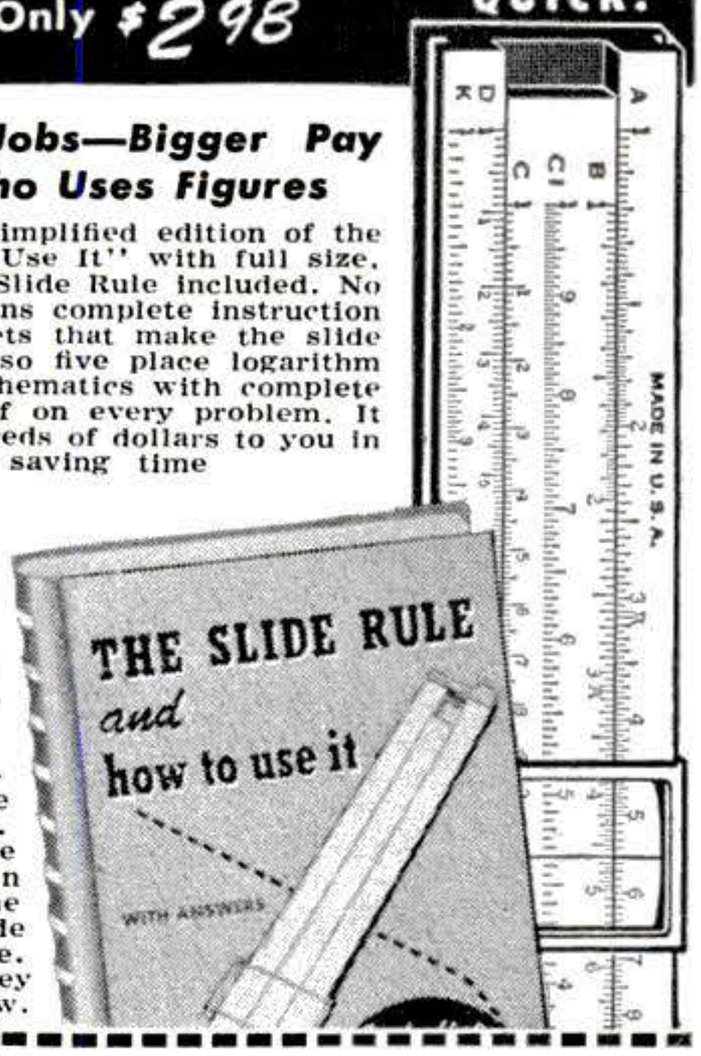

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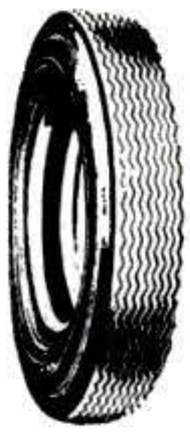

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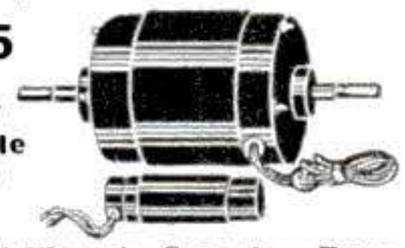

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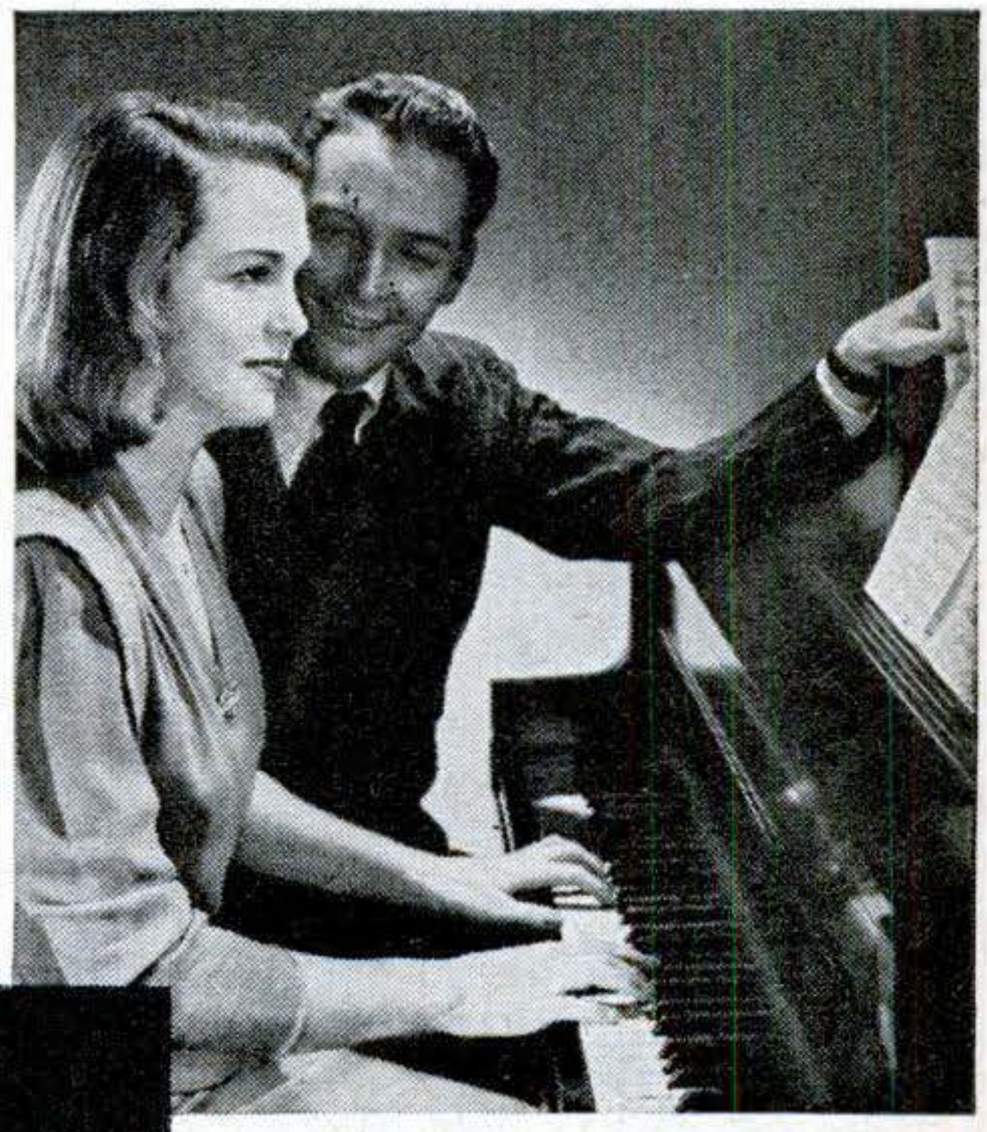

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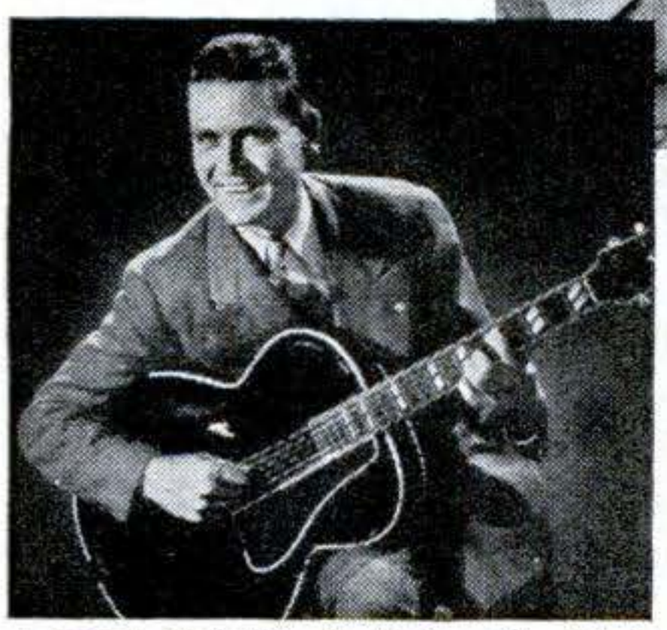

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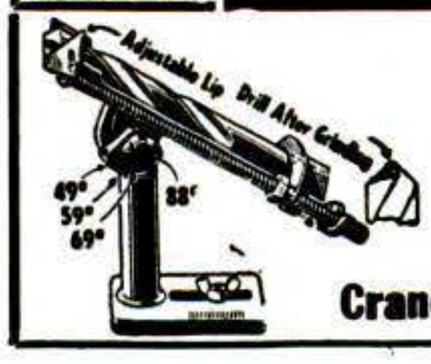

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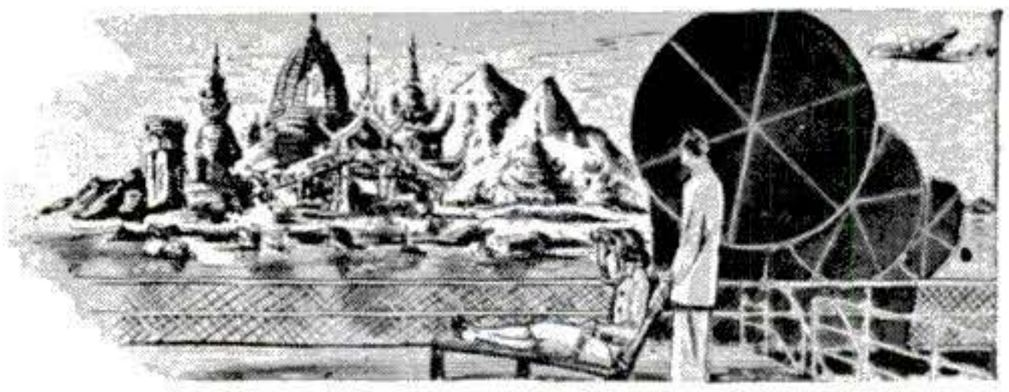

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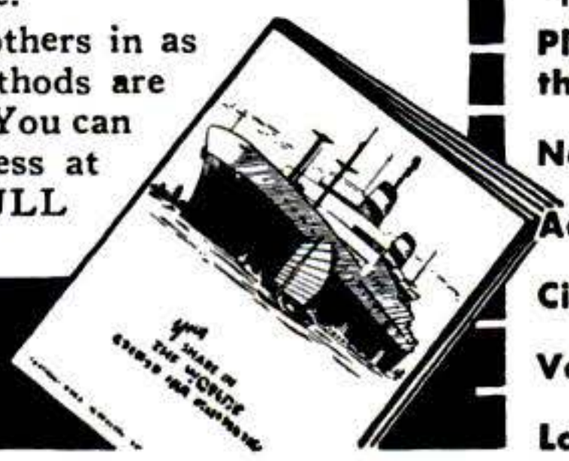

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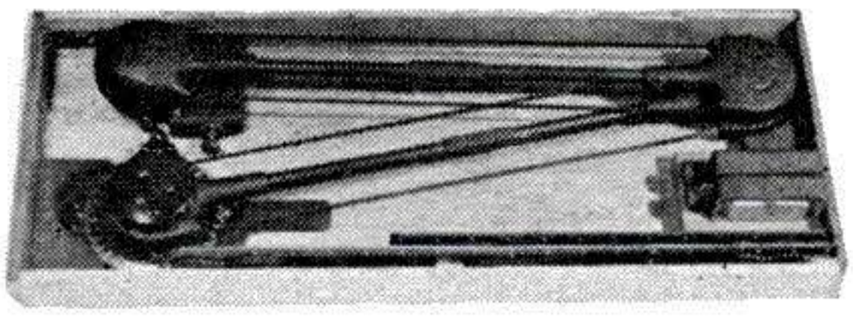

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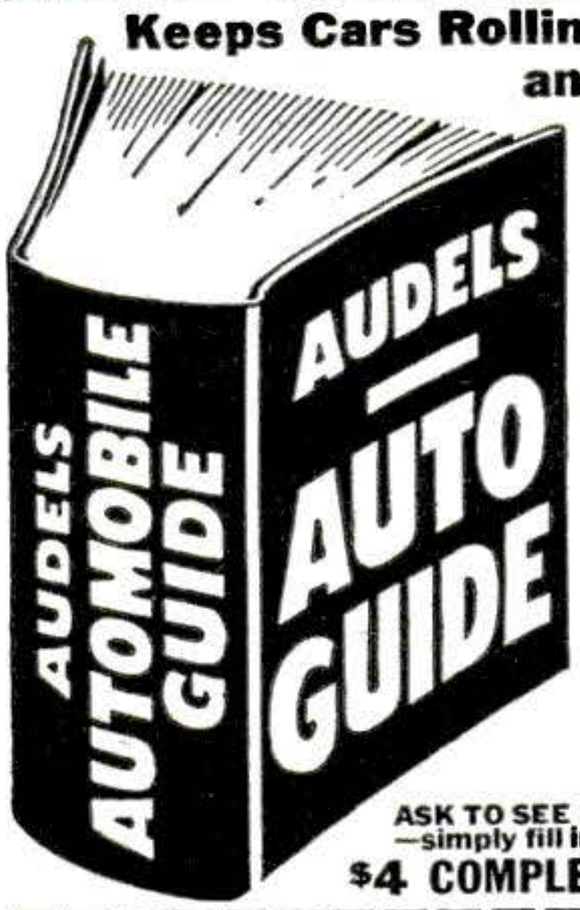

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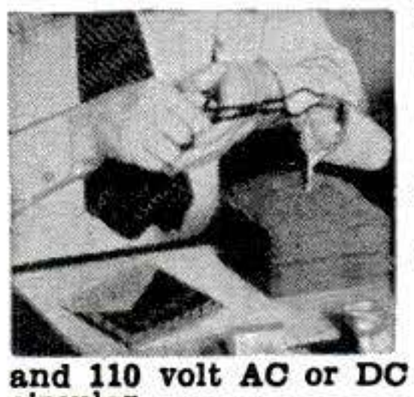

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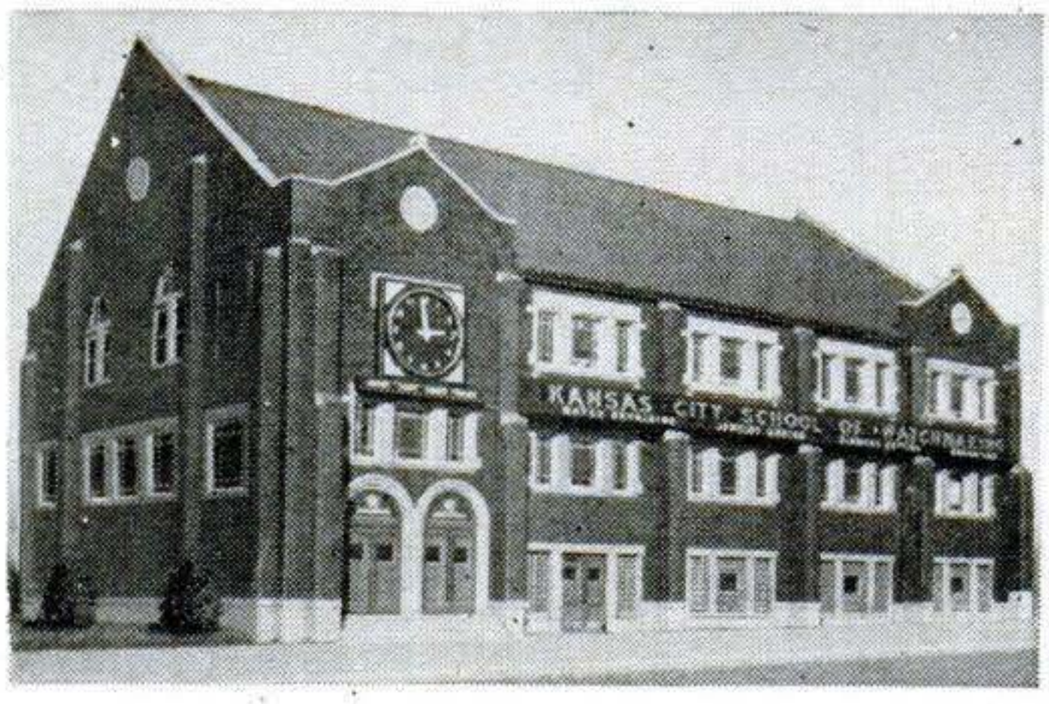

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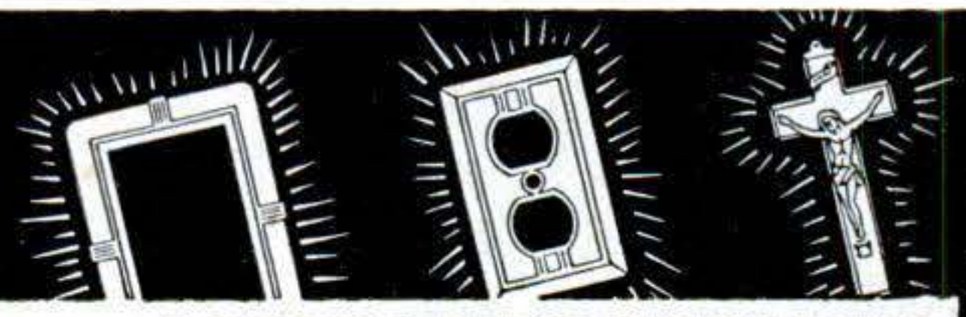

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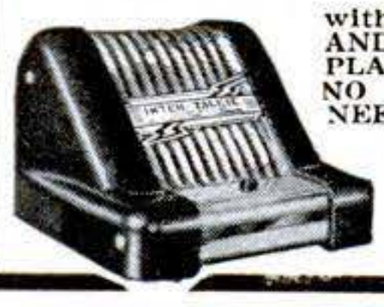

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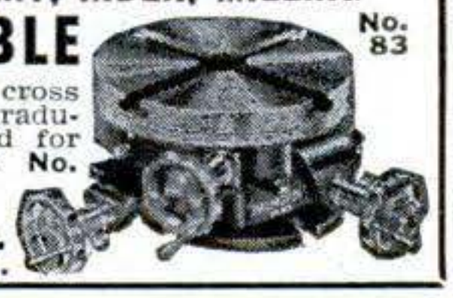

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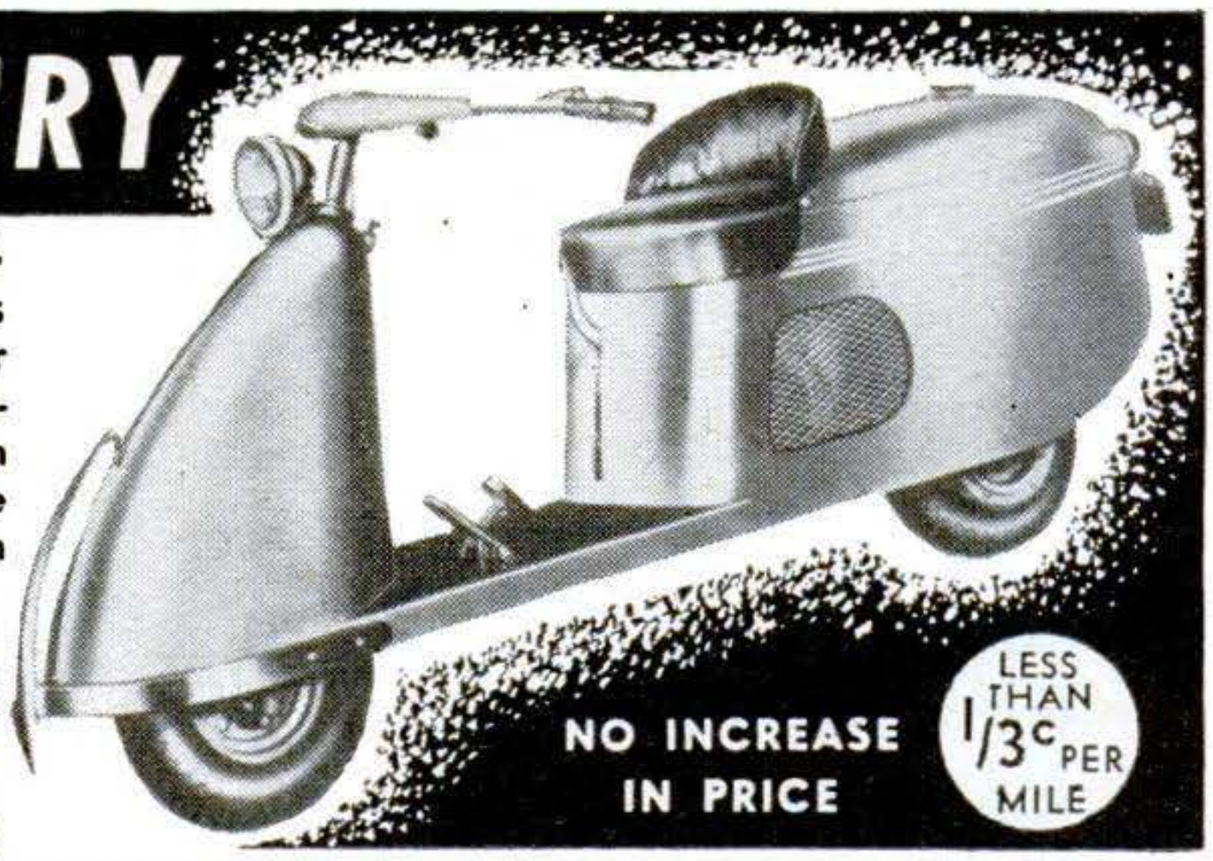

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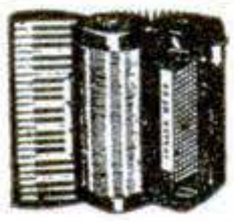

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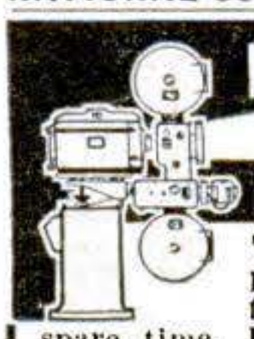

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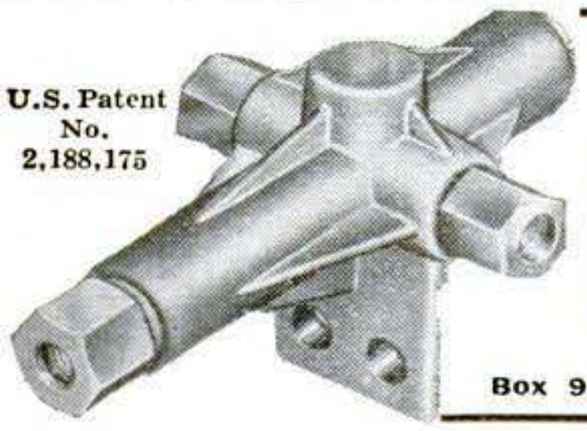

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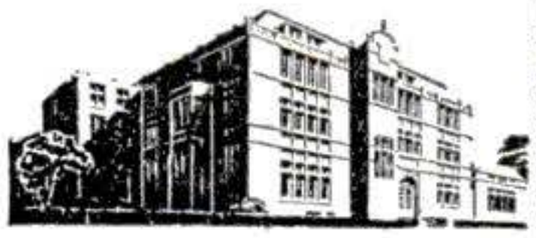

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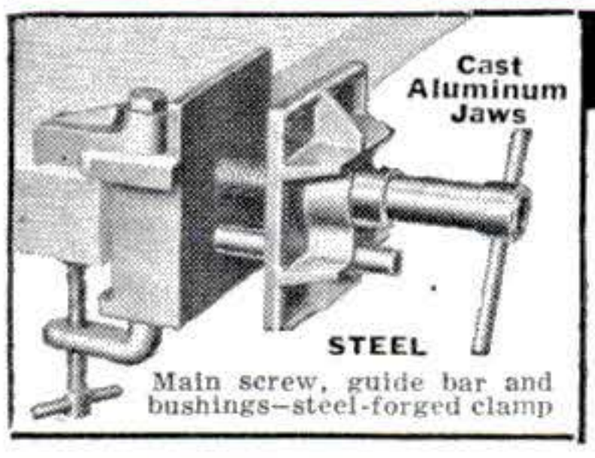

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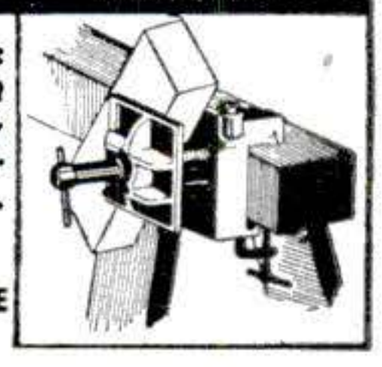

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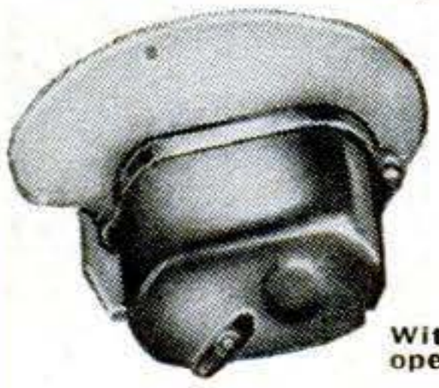

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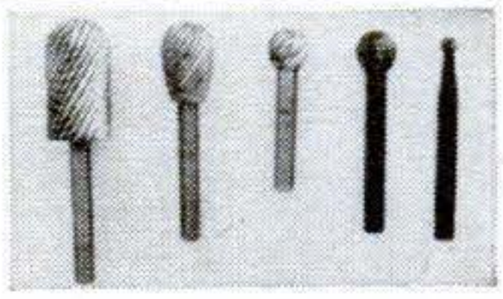

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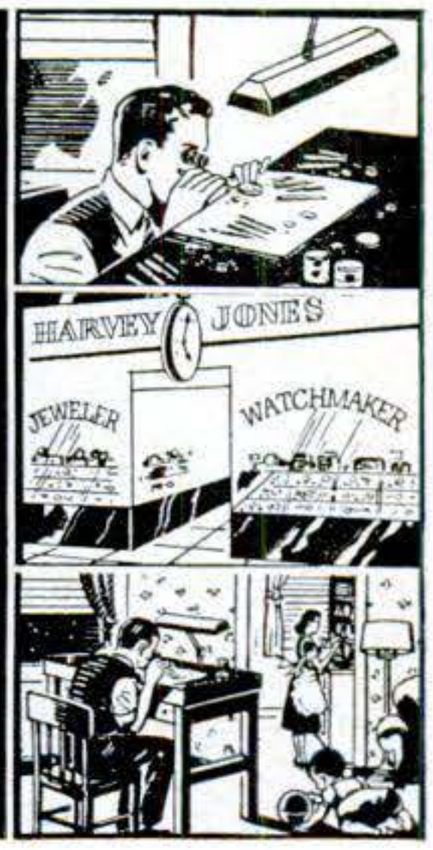

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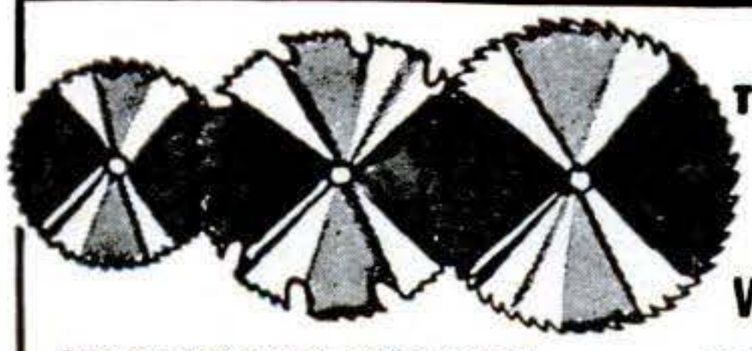

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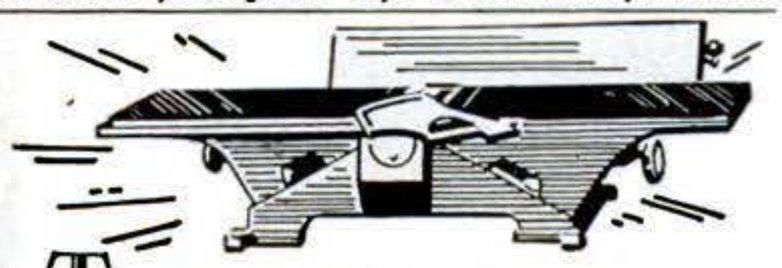

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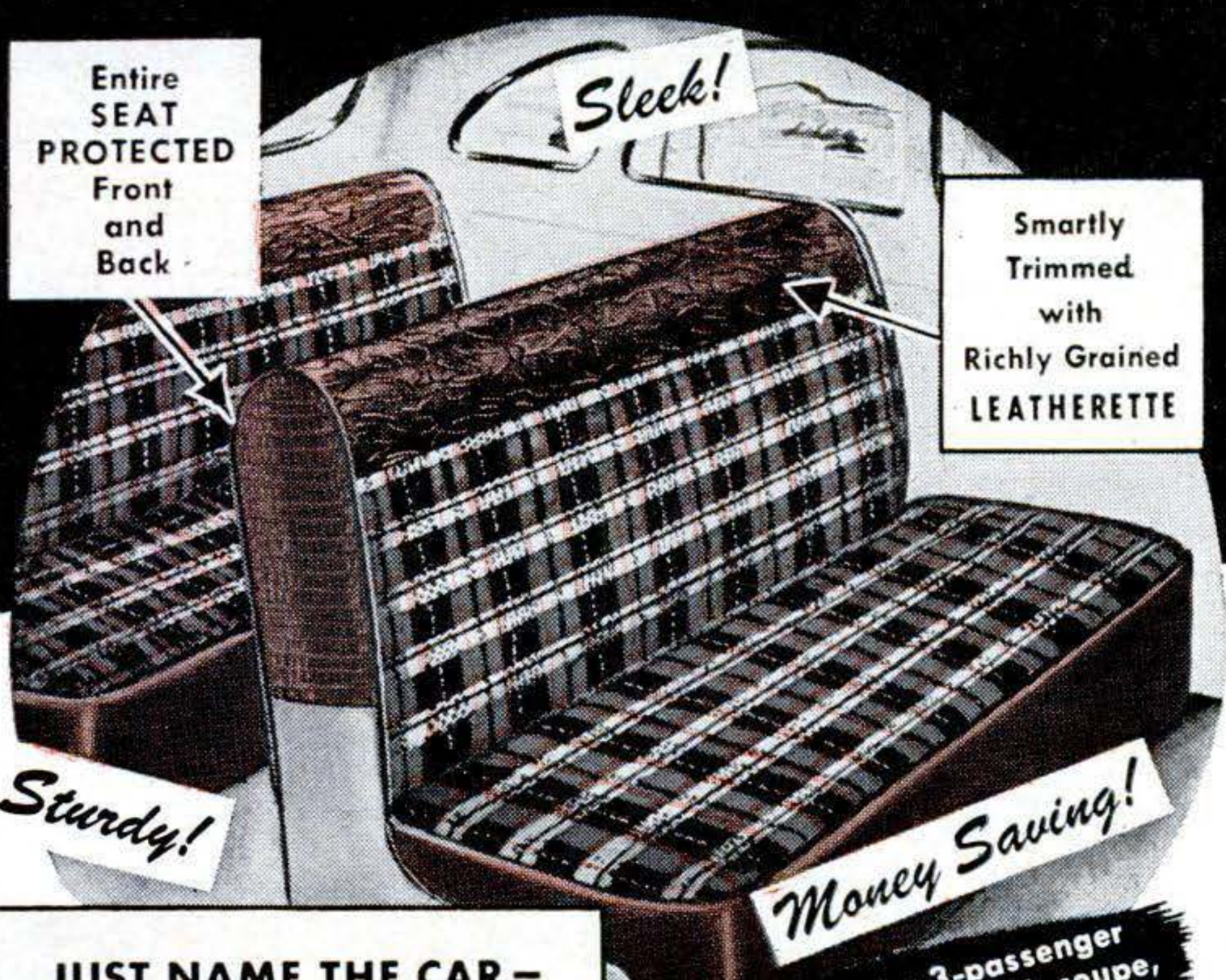

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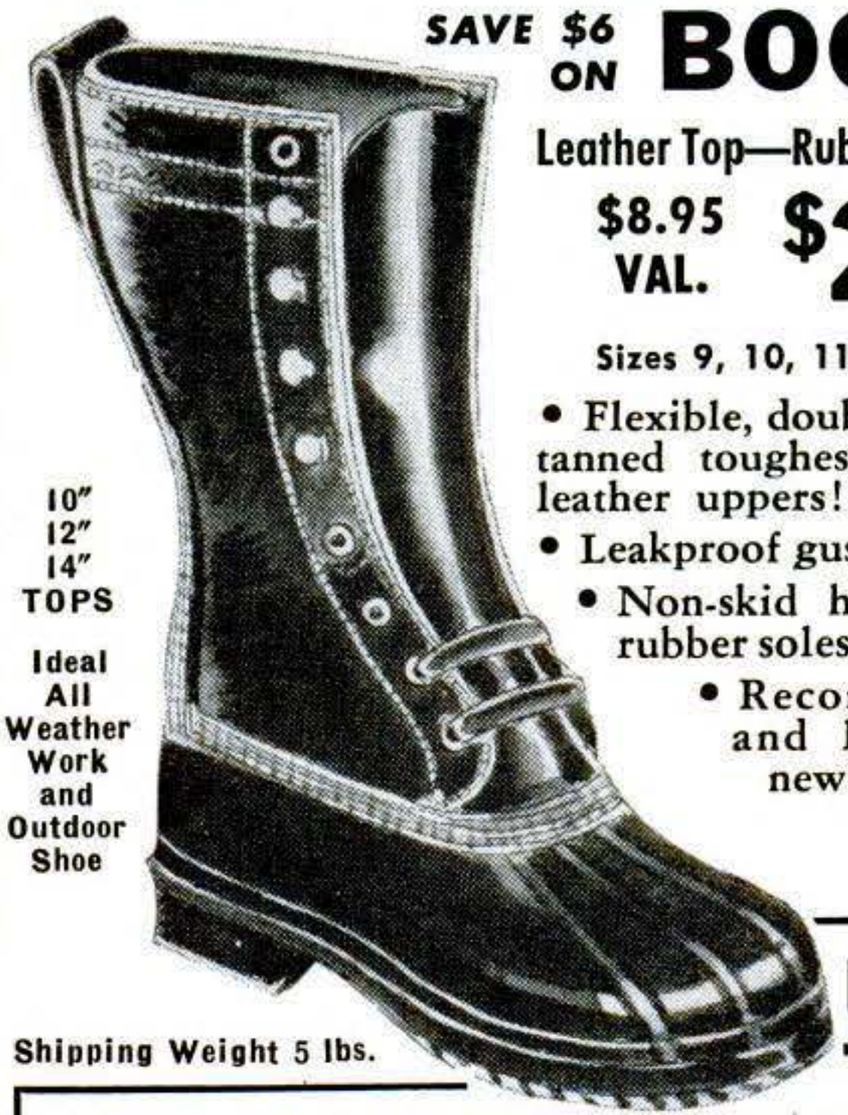

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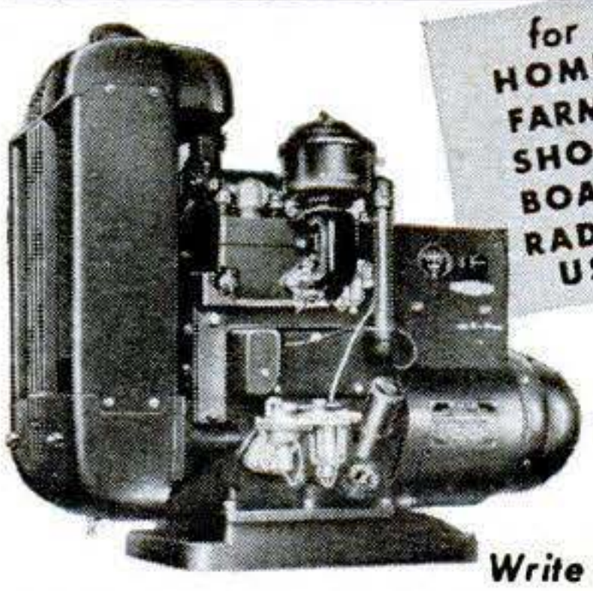

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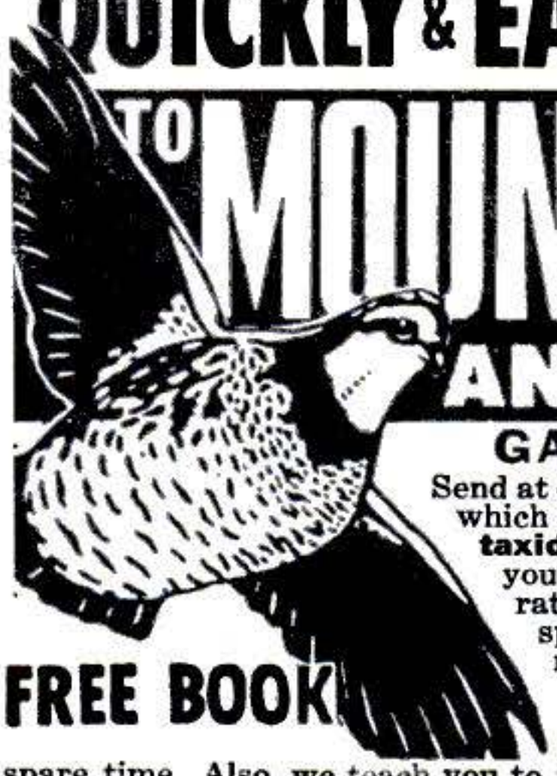

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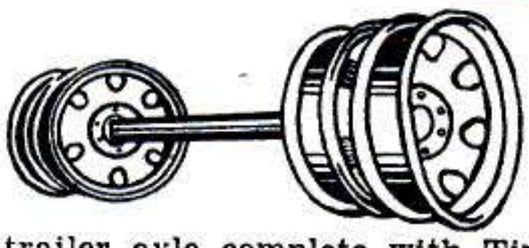

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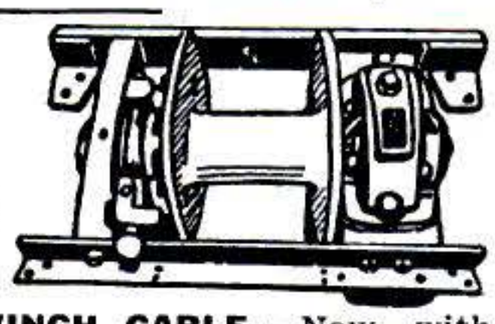

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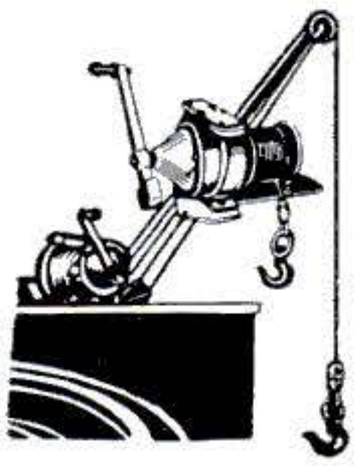

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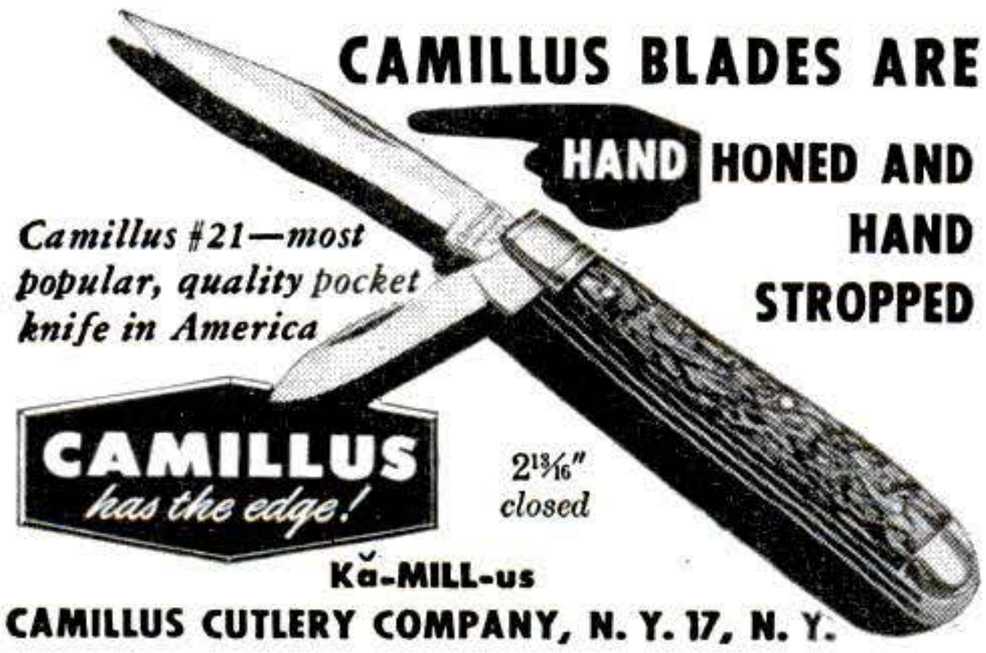

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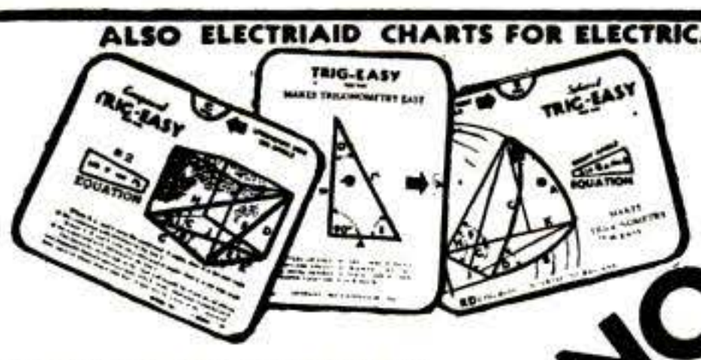

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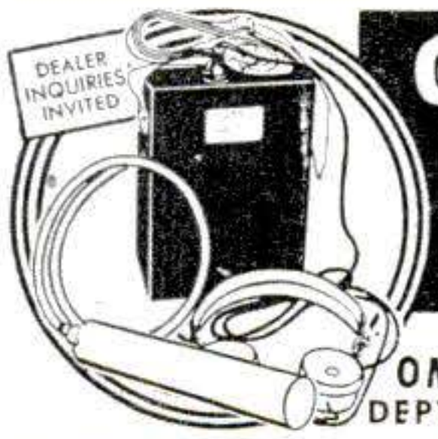

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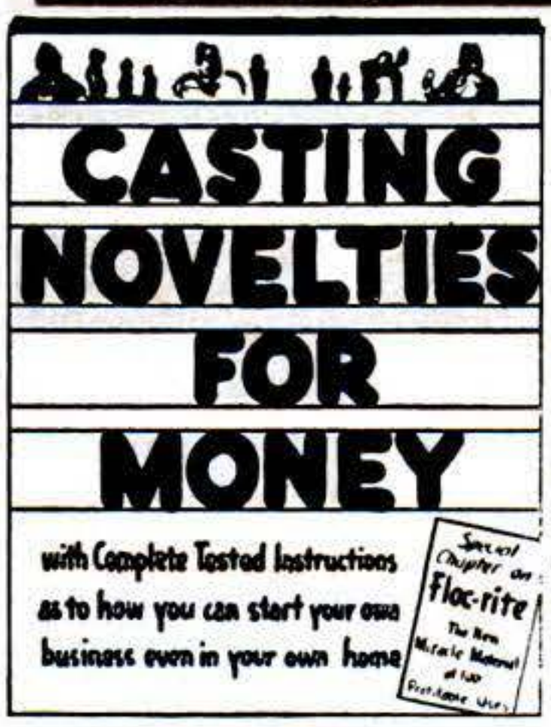

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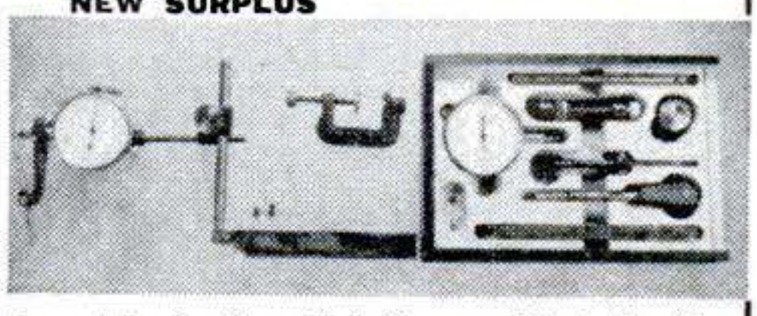

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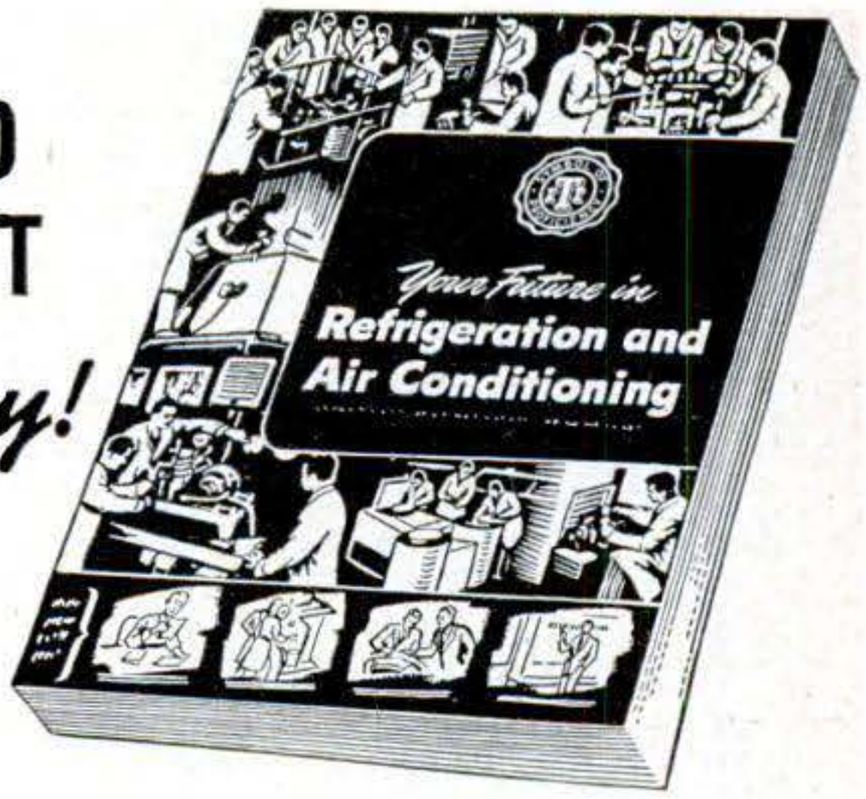

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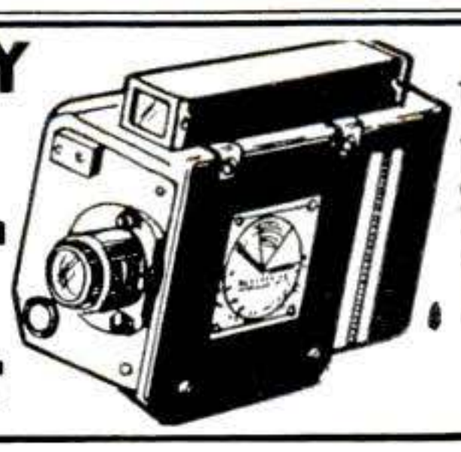

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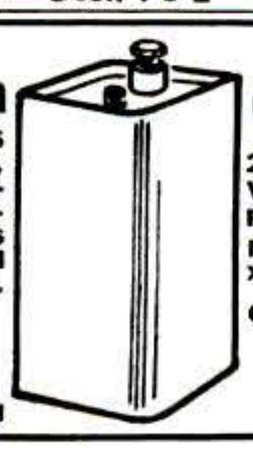

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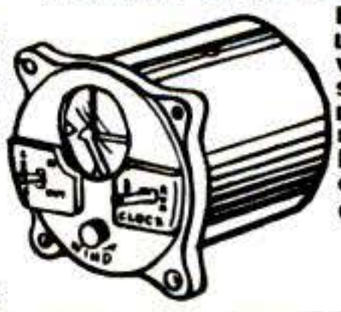

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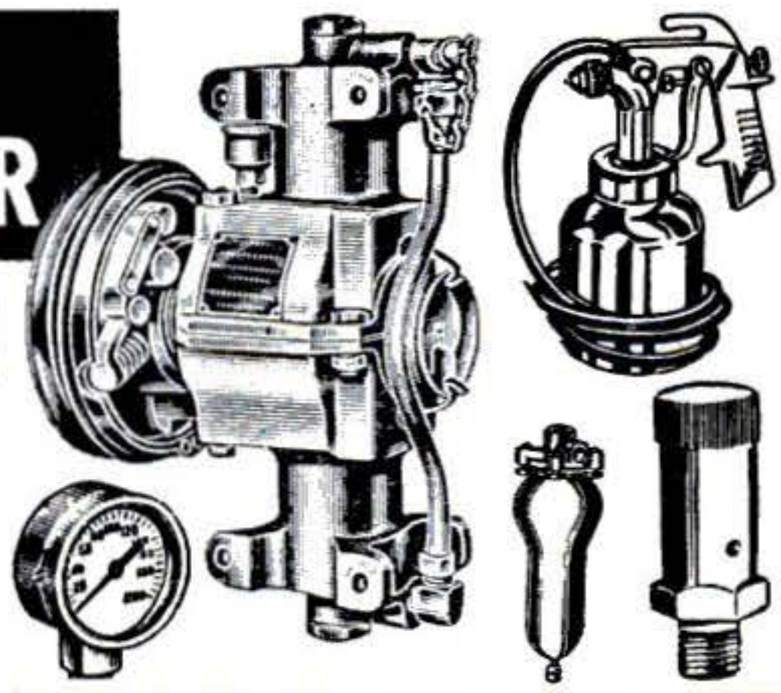

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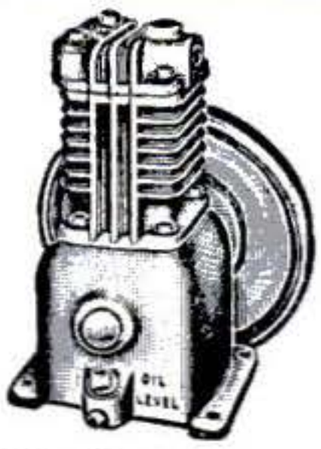

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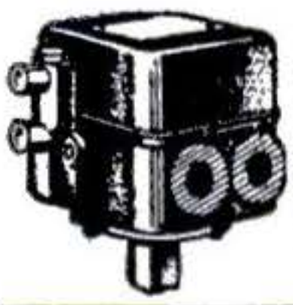

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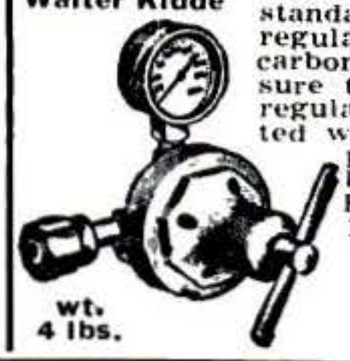

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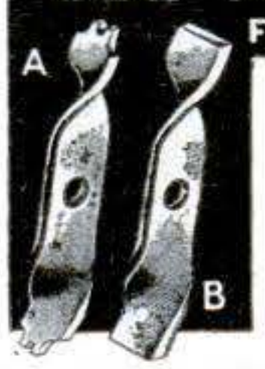

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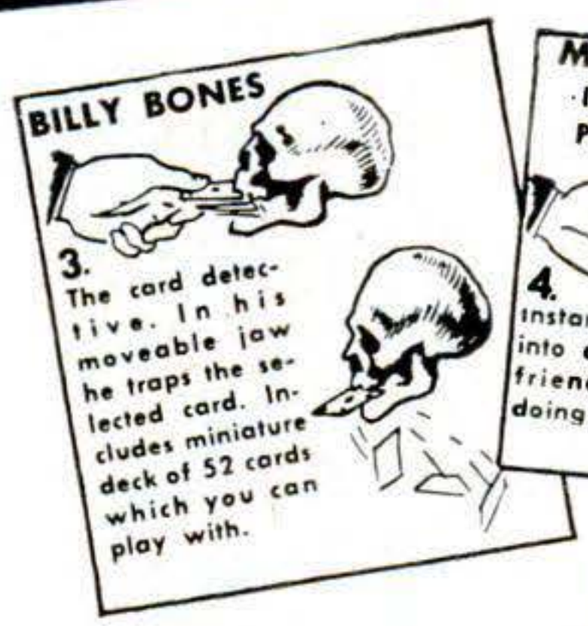

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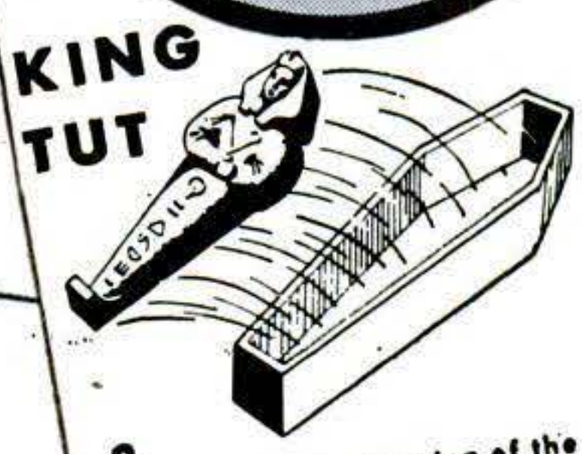

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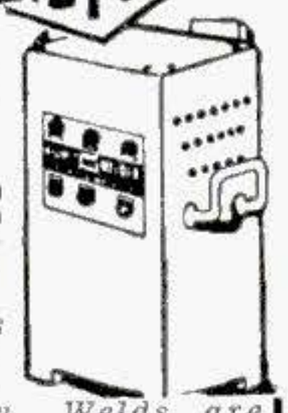

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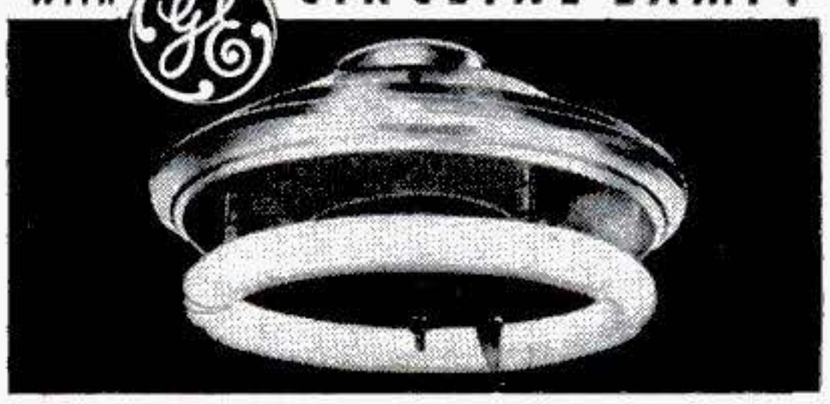

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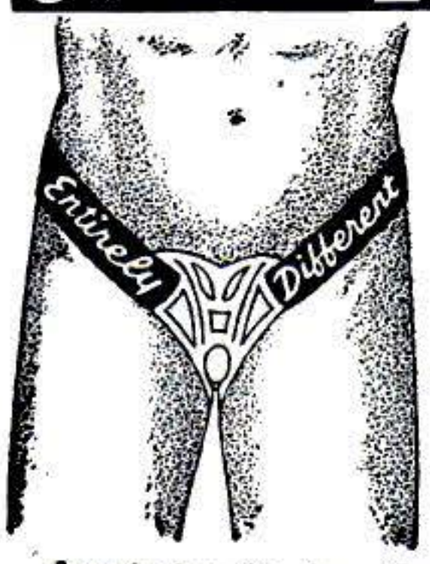

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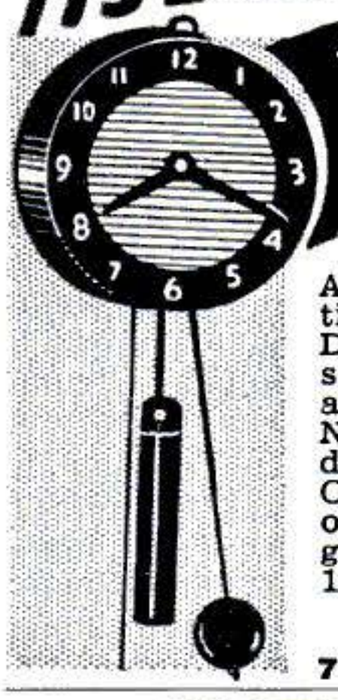

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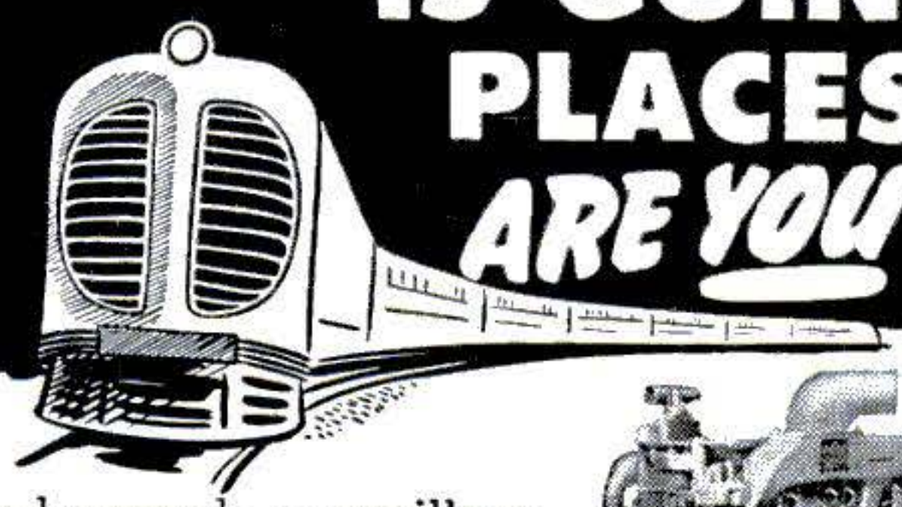

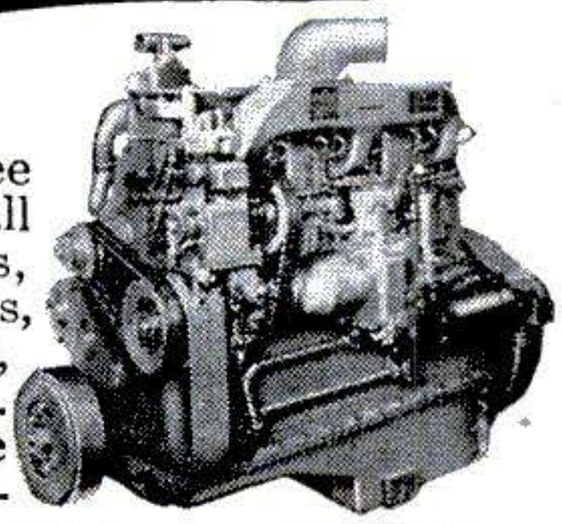

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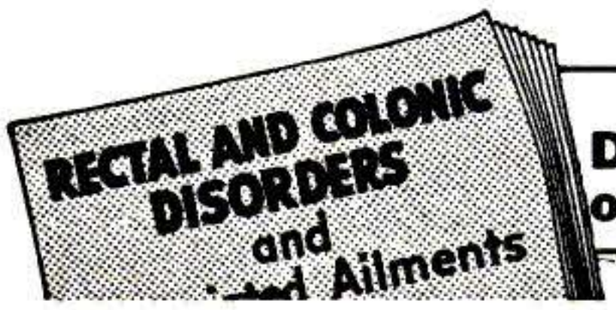

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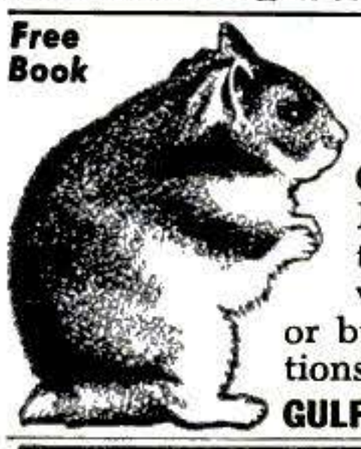

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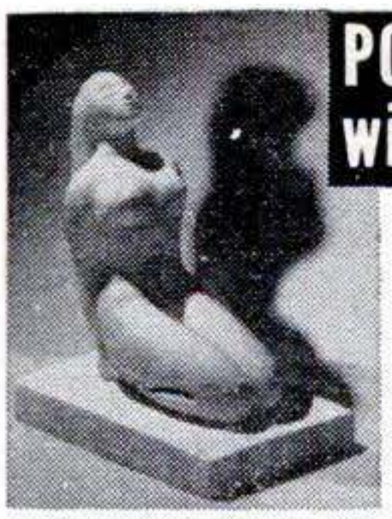

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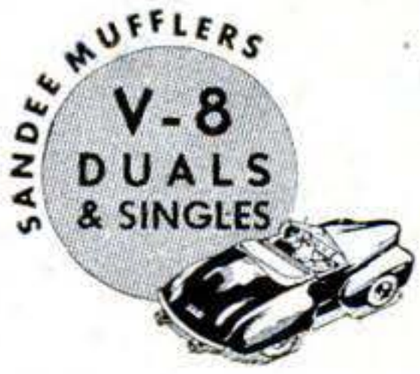

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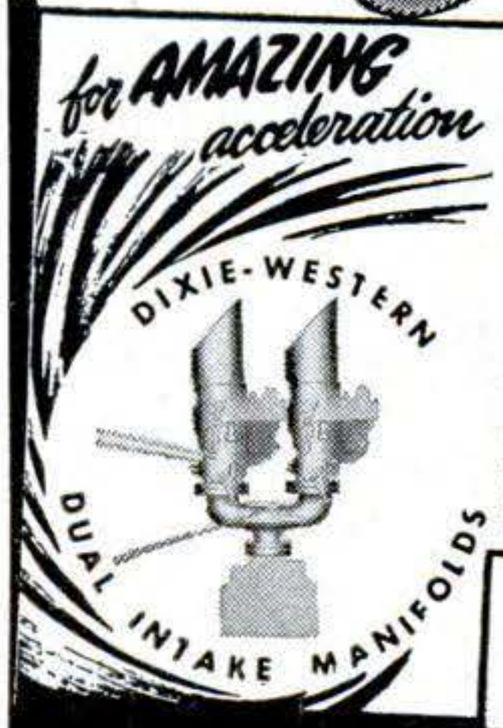

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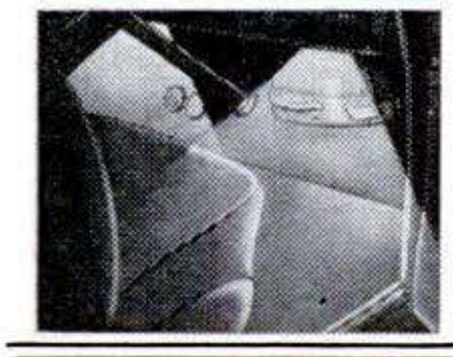

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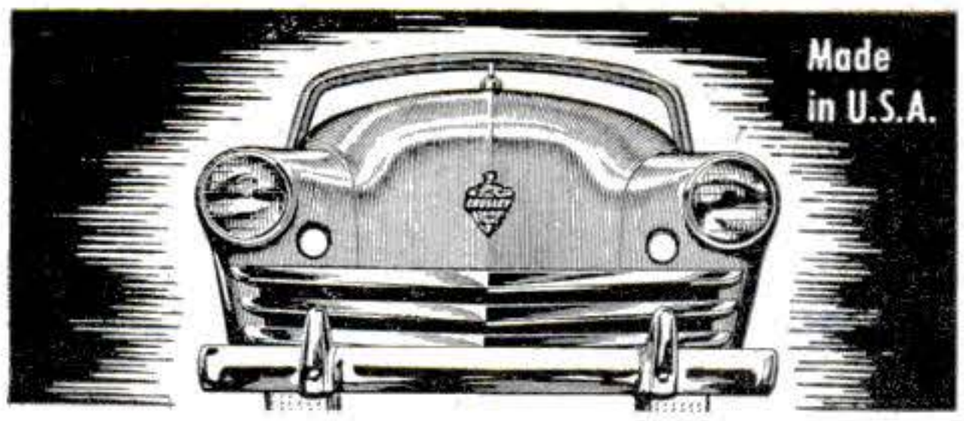

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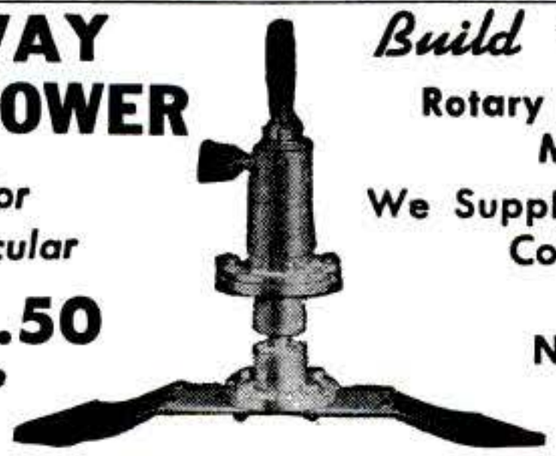

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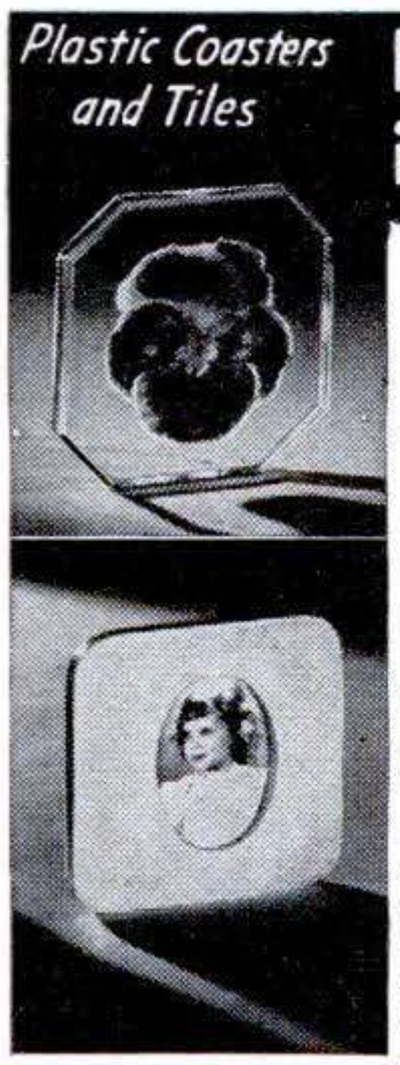

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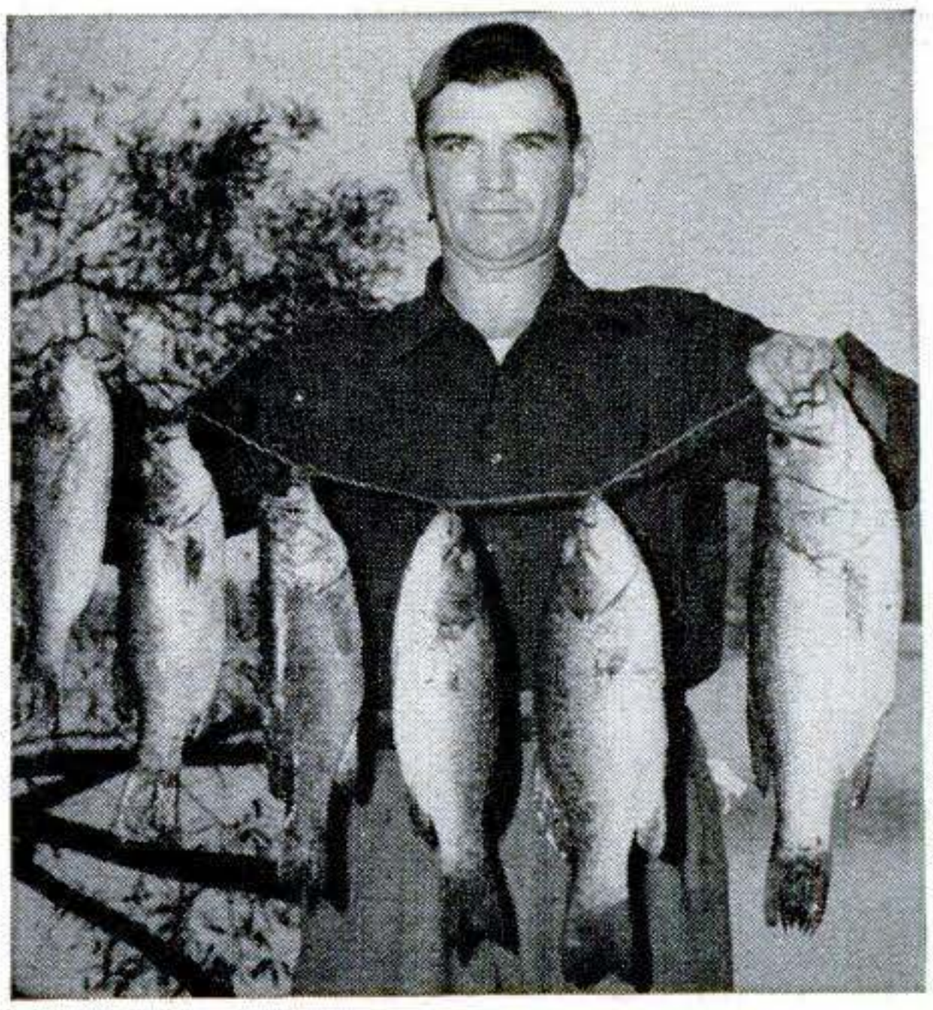

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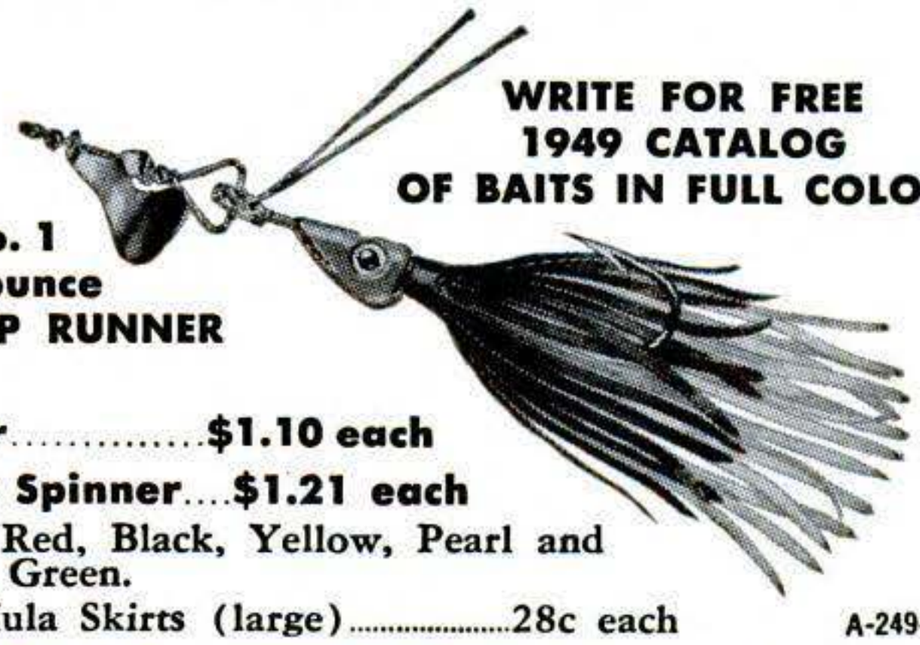

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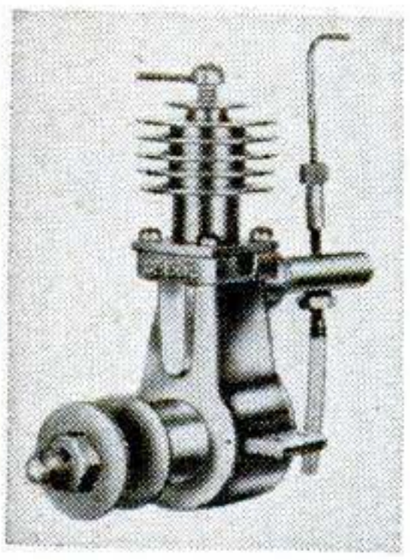

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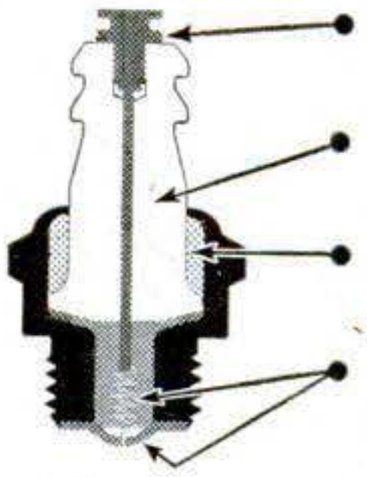

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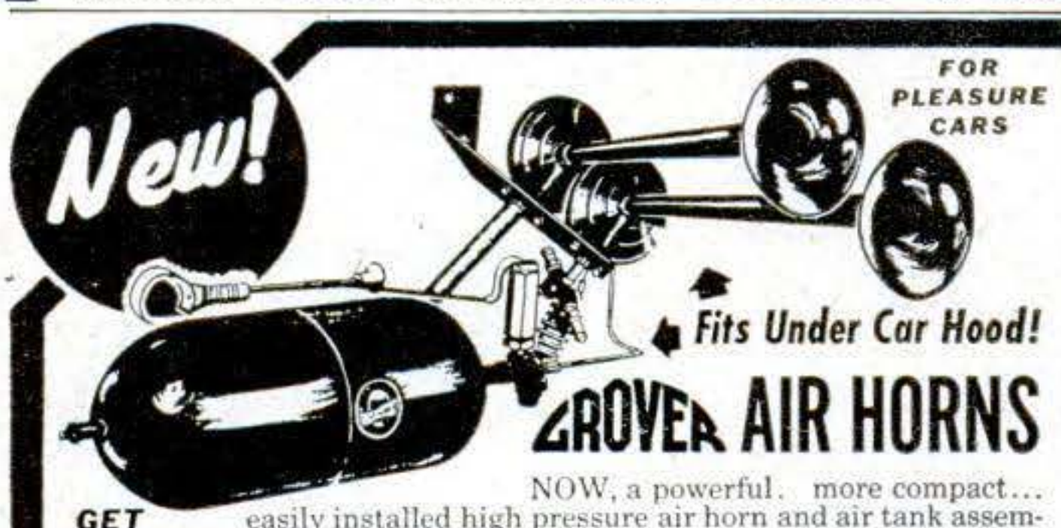

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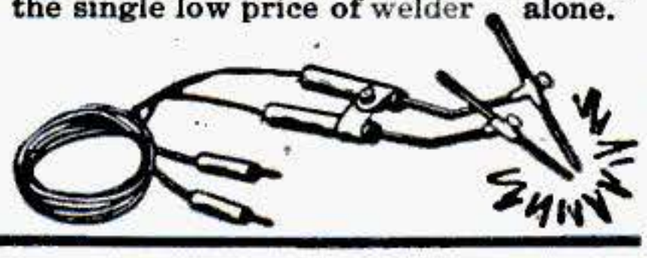

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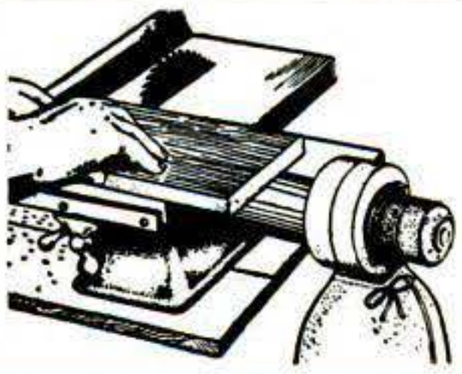

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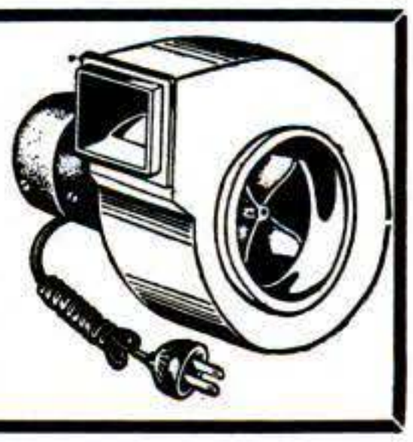

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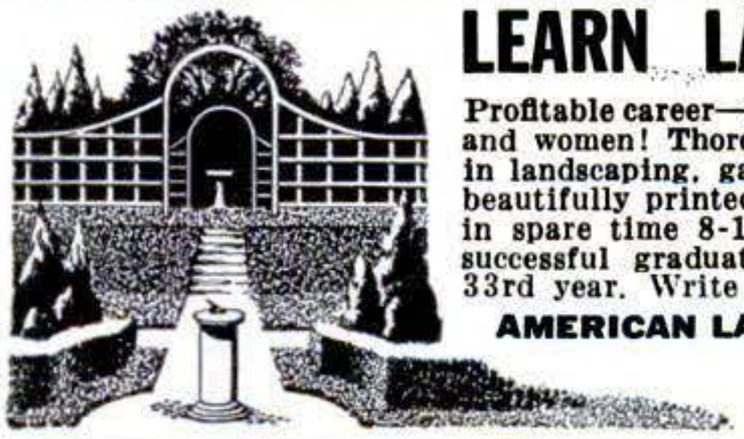

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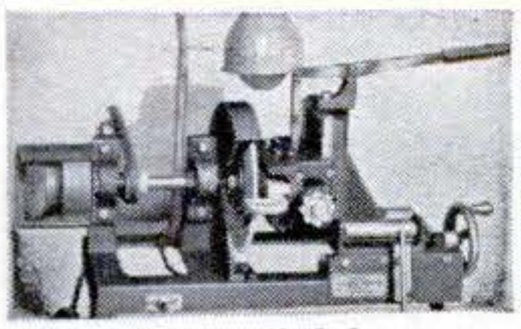

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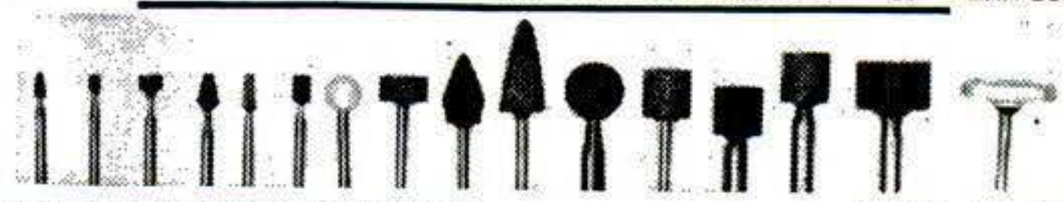

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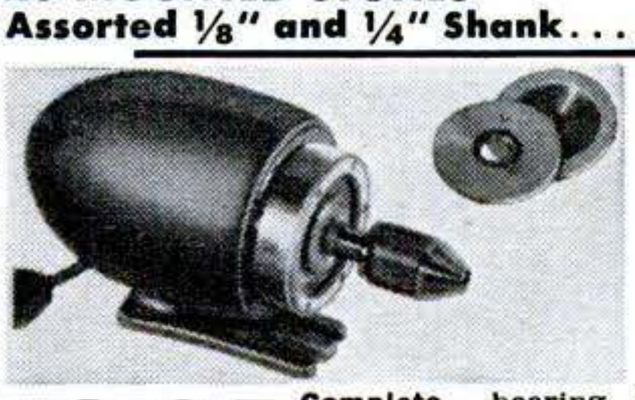

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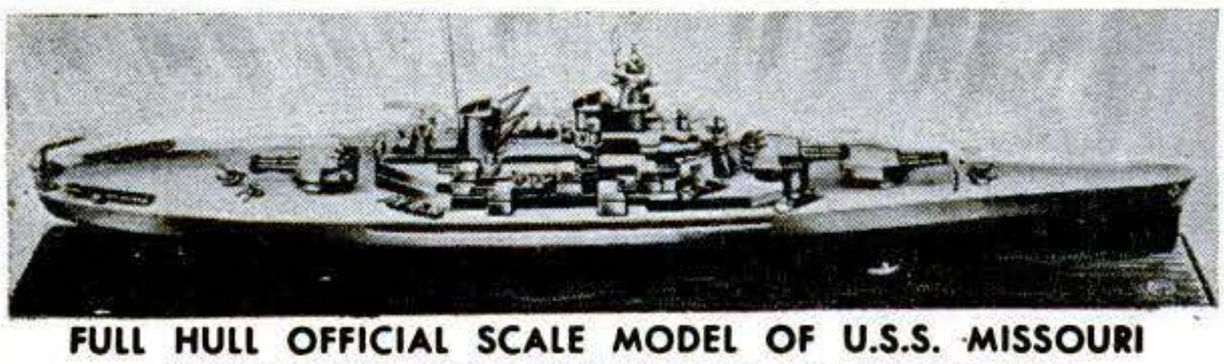

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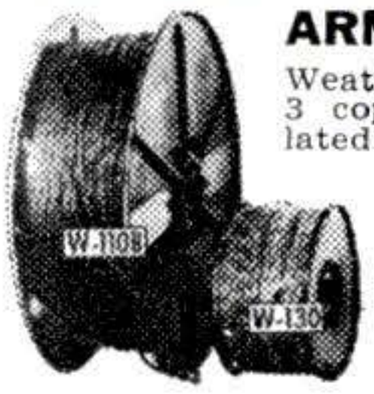

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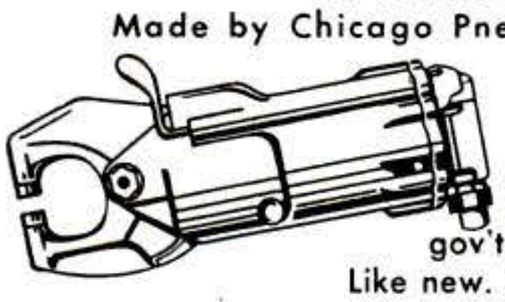

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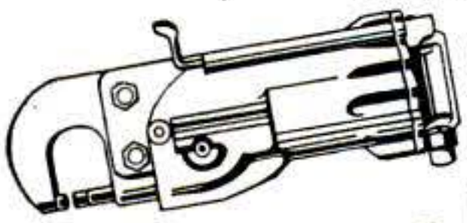

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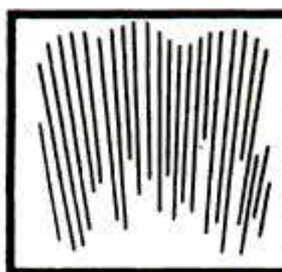

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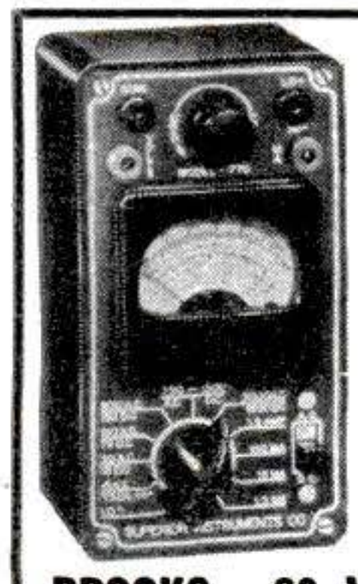

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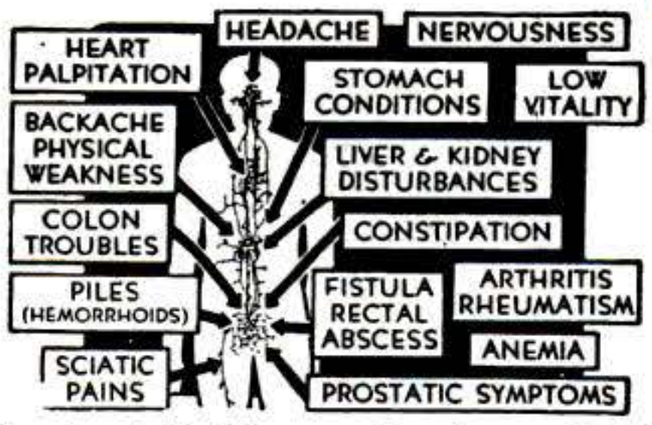

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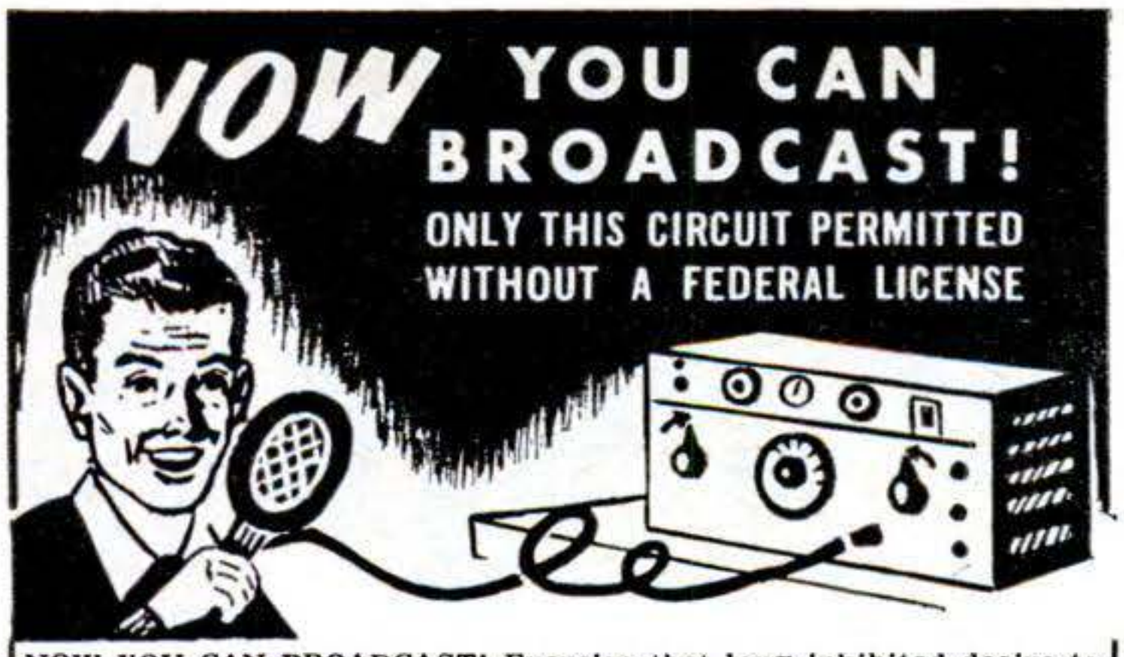

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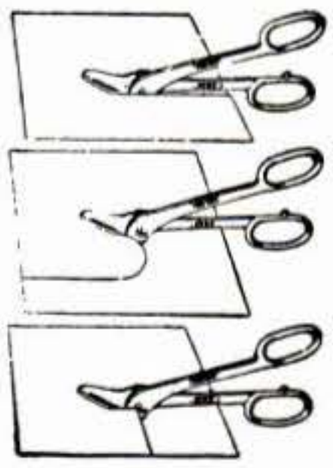

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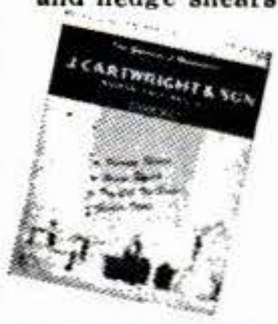

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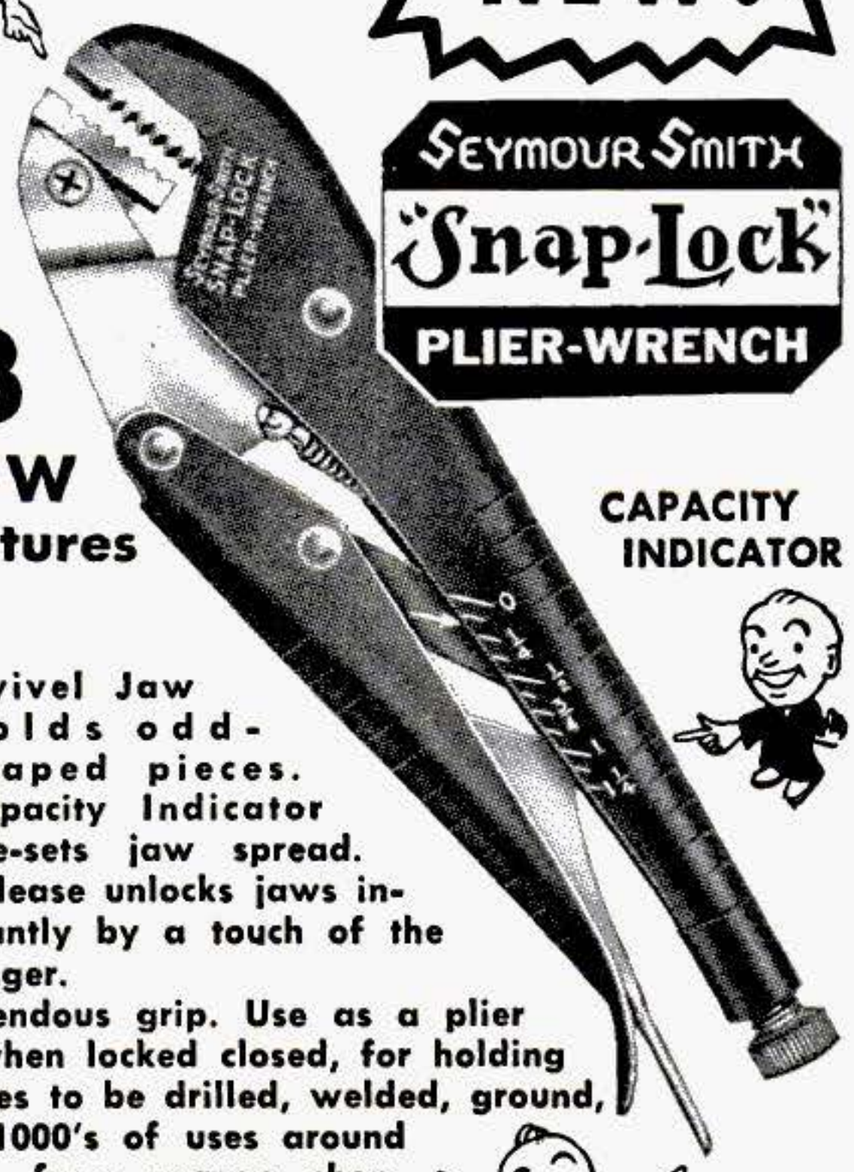

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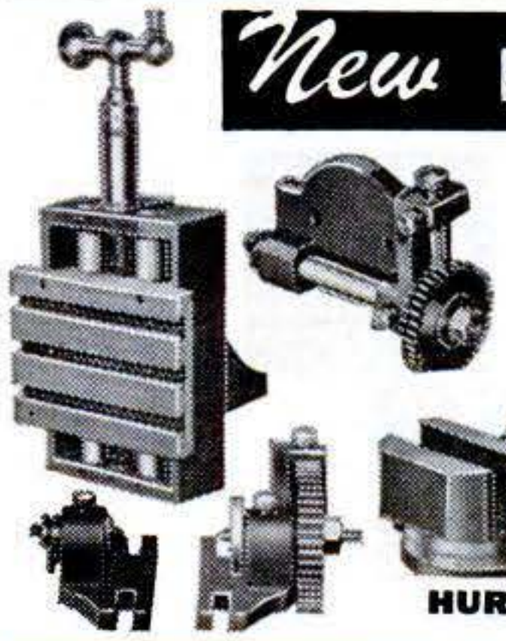

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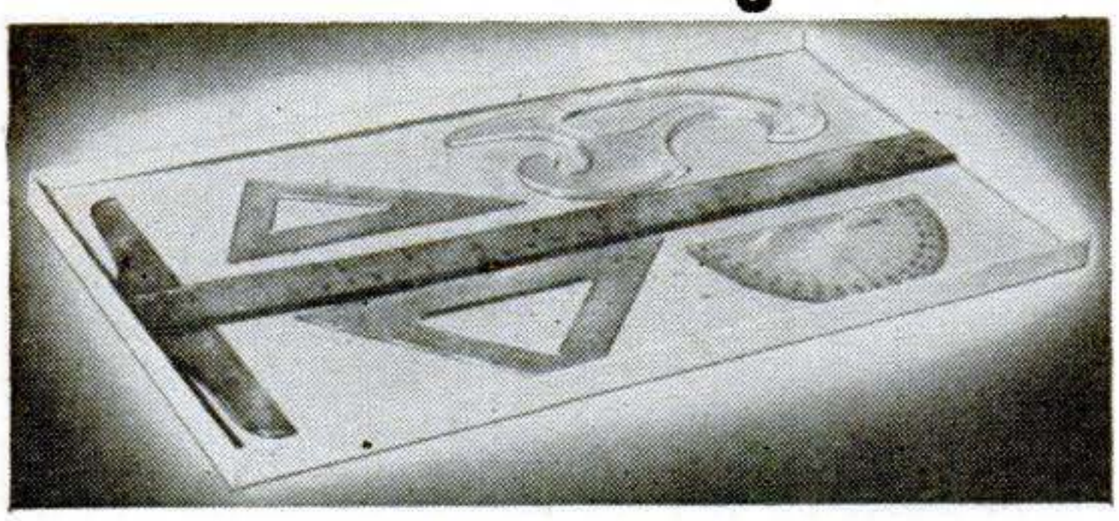

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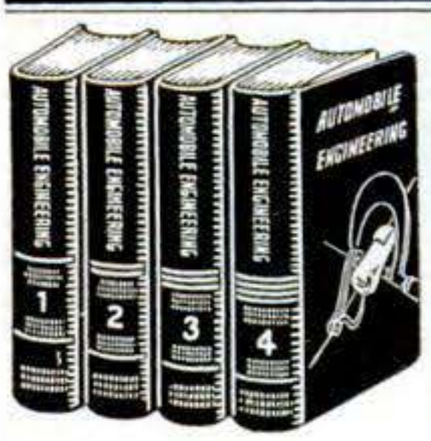

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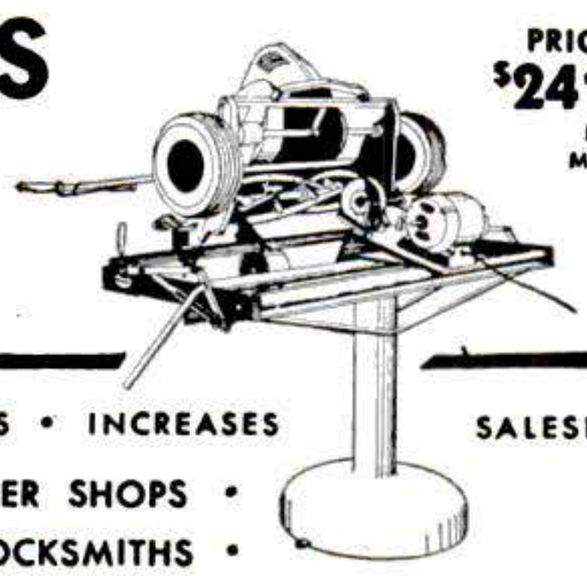

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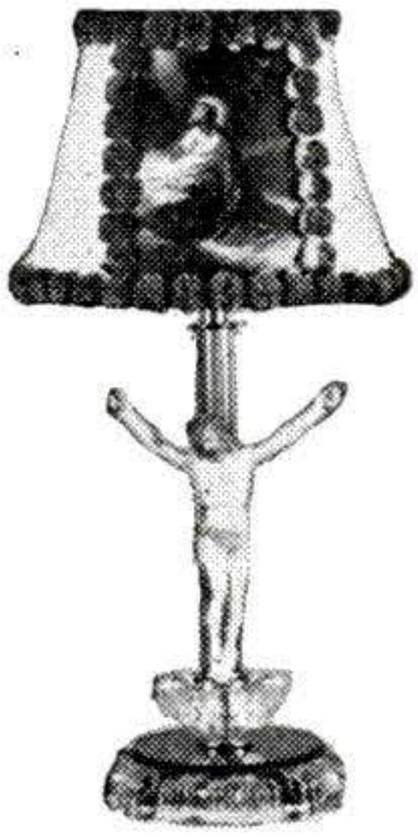

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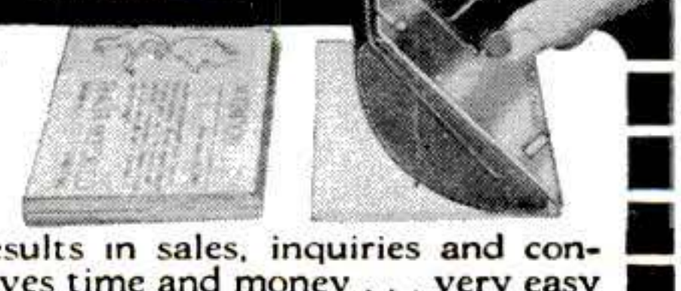

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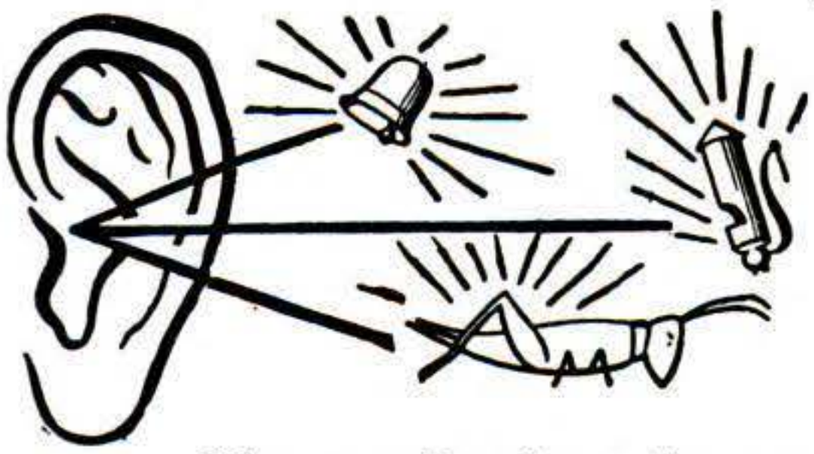

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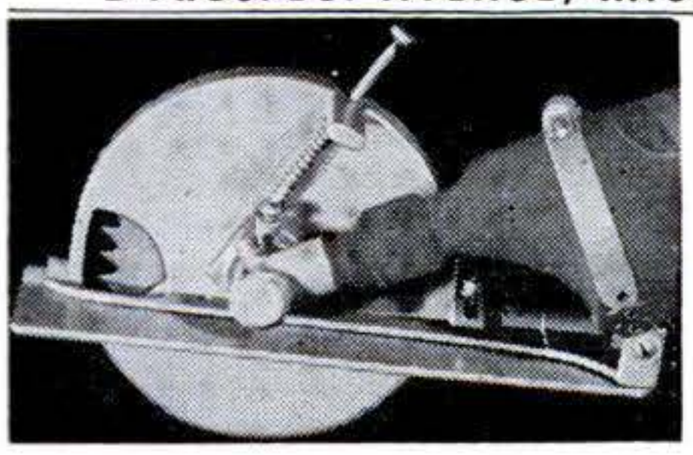

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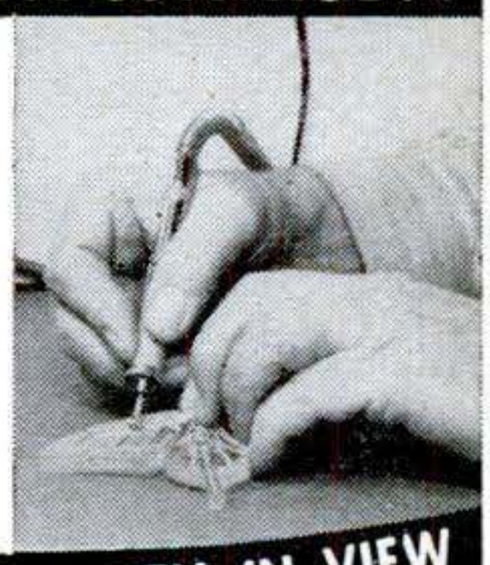

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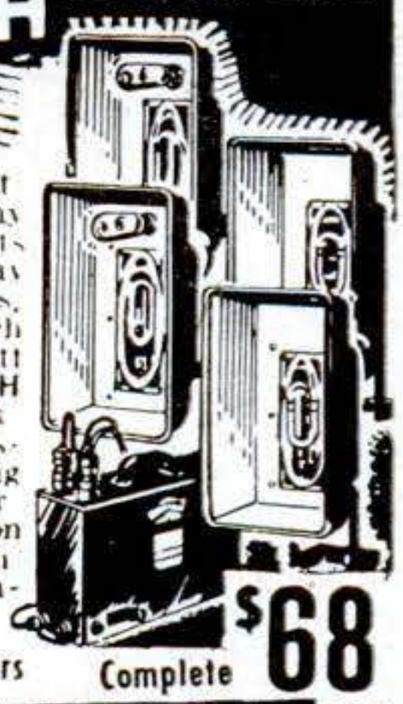

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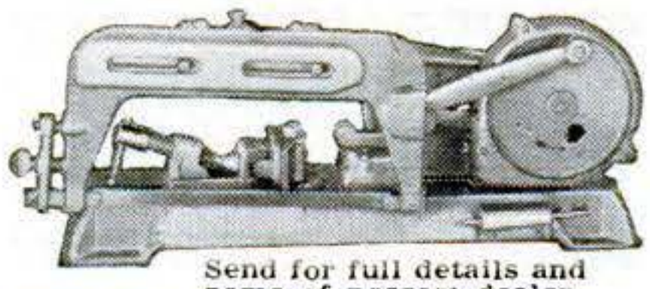

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Our Electric Rug Washer cleans rugs and carpets like new right on the customer's floor. This quick, thorough and highly efficient method removes dirt and grime, thus restoring the natural, fresh beauty of floor coverings. Anyone can run it. Rugs and carpets are not harmed.

There are hundreds of possible customers in YOUR vicinity. Most of them have several rugs needing **regular** cleaning. To get a quick start, shampoo a few rugs or carpets. These customers tell their friends and soon you should have an independent, prosperous business, and you should be able to keep it growing. Send the coupon RIGHT NOW for booklet that explains everything.

Every Machine Guaranteed and Easy to Own

You take no risk. These wonderful, fully guaranteed machines have been used and endorsed by largest hotels, railroads—also used by U. S. Government. Many individuals have built up successful businesses that made big profits. Mail the coupon TODAY and we will send complete information, including how to start and succeed in YOUR business **without a large investment.** Don't delay your BIG opportunity. Send the coupon AT ONCE.

MAIL COUPON TO VON SCHRADER MFG. CO., A-293, RACINE, WIS.

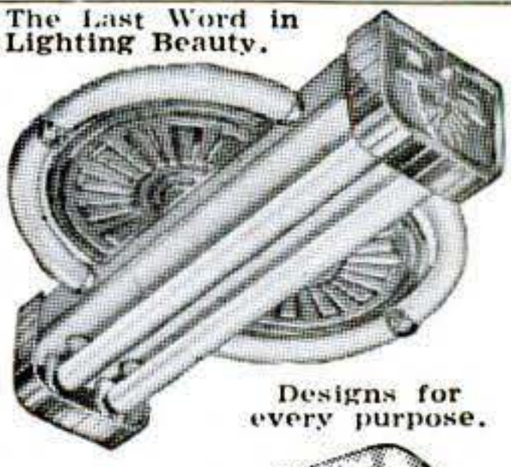
Biggest Scoop in Fluorescent!

Spectacular new combinations with straight tubes – or new beauty with Half Circles.

Be First To Take Orders For **Westinghouse**

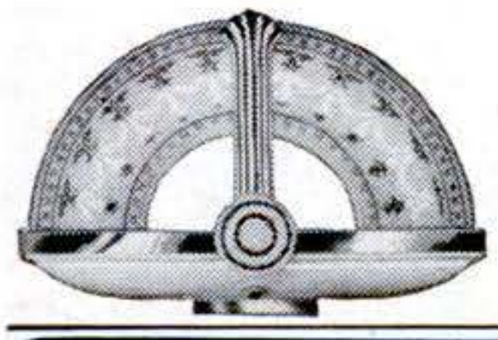
AMAZING NEW CIRCL-ARC LAMPS

The Last Word in Lighting Beauty.



Designs for every purpose.

BRAND NEW—Cash in quick and big on biggest lighting scoop in history. Beautiful new Half Circle Lamps send Fluorescent Sales to New, all-time HIGH! Nothing like them ever shown before. Old-style straight tube fluorescents can be bought anywhere, but hurry and you'll be cleaning up with WESTINGHOUSE Circl-Arc long before they reach the stores. New buyers— new profits waiting everywhere!



20 New, Modern Designs.

FREE SELLING OUTFIT

Send name on Penny Post Card for Complete Selling outfit. Rush name today and have record breaking profits next week.

MAXILUME CO., 125 W. Hubbard St., Dept. 92, Chicago 10, Illinois

BURN WATER IN YOUR CAR!

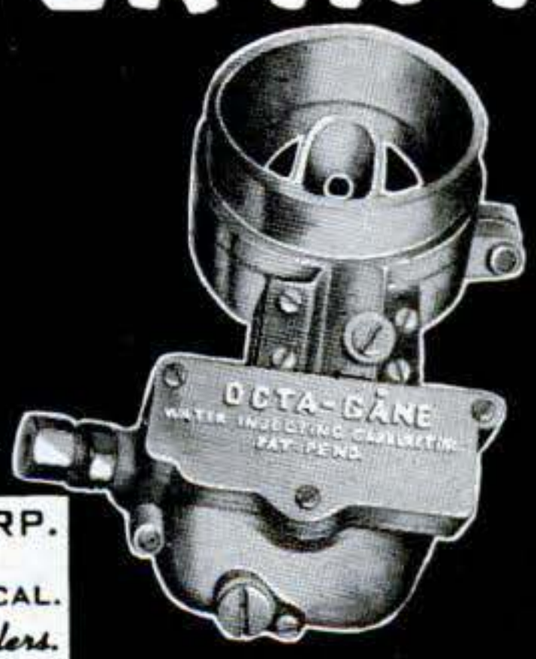
The new OCTA-GANE Water Injector is designed to give your car premium performance from low grade fuels. In addition it will measurably increase power and mileage completely eliminate engine "ping" or "knock", and keep your engine internally clean.

The OCTA-GANE is a well constructed unit, engineered to last for the life of your car. It comes complete with a stainless steel tank and all necessary fittings and brackets for mounting. Installation is a simple matter of a few minutes. A one year guarantee comes with each OCTA-GANE.

The OCTA-GANE is priced at only $24.95 delivered and we urge you to take advantage of the special coupon at right to give your car a new lease on life.

We will be pleased to send you full descriptive literature at your request.

COMMONWEALTH CARBURETOR CORP.
SUCCESSORS TO CONTINENTAL CARBURETION CO
DIV. 14-A, 1478 UNIVERSITY AVENUE, BERKELEY, CAL.
Inquiries invited from established automotive dealers.



COMMONWEALTH CARBURETOR CORP.
DIV. 14-A, 1478 UNIVERSITY AVENUE, BERKELEY, CAL.

SIRS: PLEASE SHIP TO ME IMMEDIATELY ONE COMPLETE OCTA-GANE WATER INJECTOR UNDER THE PLAN CHECKED BELOW.

☐ $1.00 ENCLOSED, PAY POSTMAN BALANCE C.O.D.
☐ $24.95 ENCLOSED, SHIP FULLY PREPAID.

(PLEASE PRINT PLAINLY)

NAME:_____
STREET:_____
CITY:_____ STATE:_____
MAKE & YEAR OF CAR:_____
MODEL:_____ NUMBER OF CYLINDERS:____

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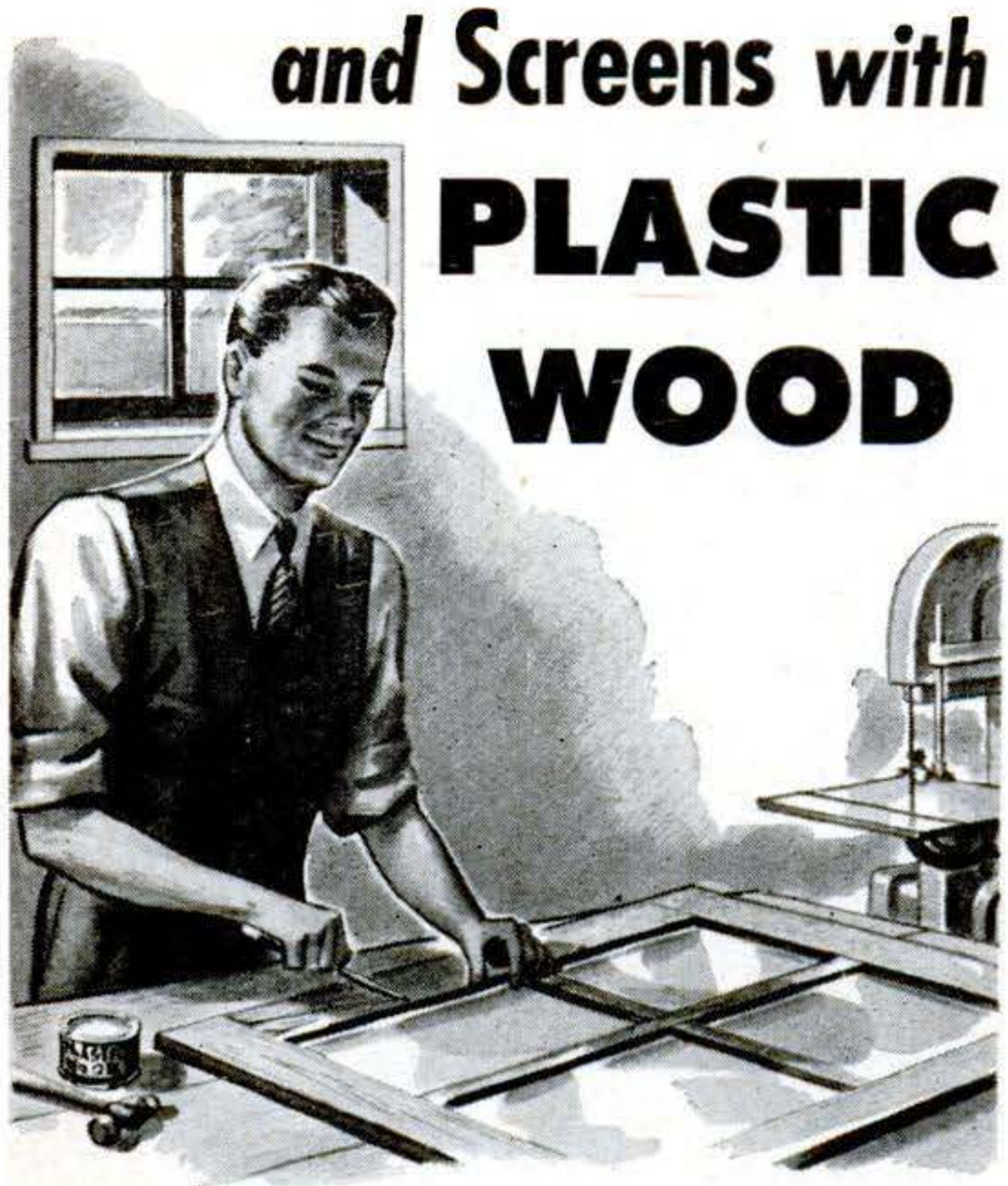
Repair Storm Windows and Screens with PLASTIC WOOD



When making new screens, or replacing old rusted screen, apply thin layer of PLASTIC WOOD around frame after tacking down screen. This gives greater strength to the frame. PLASTIC WOOD can be easily shaped to match broken molding. Valuable in replacing rotted wood in storm windows.

. . . dozens of other uses

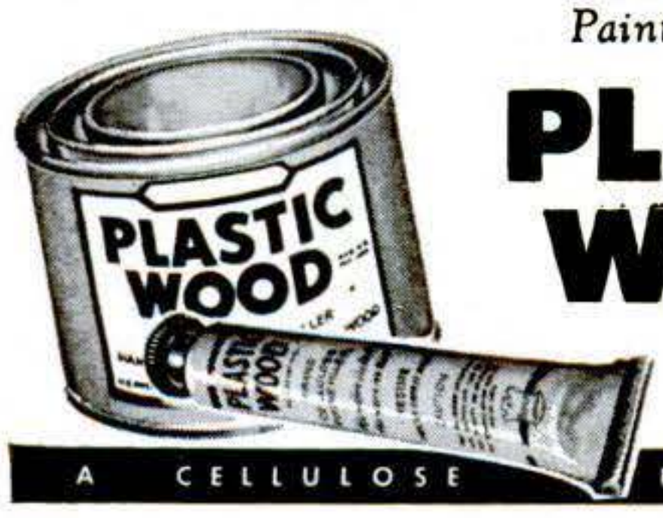
FOR FILLING . . .
- Cracks in floors
- Countersunk screws
- Chipped furniture
- Nail and screw holes

FOR REPAIRING . . .
- Loose tiles
- Loose casters
- Broken balusters
- Broken furniture

- PLASTIC WOOD SOLVENT is indispensable to the home workshop hobbyist for controlling the consistency of Plastic Wood and removing dried Plastic Wood from hands and tools.

T.M. Reg. U. S. Pat. Off.

At all Hardware, Paint and 10c Stores



PLASTIC WOOD

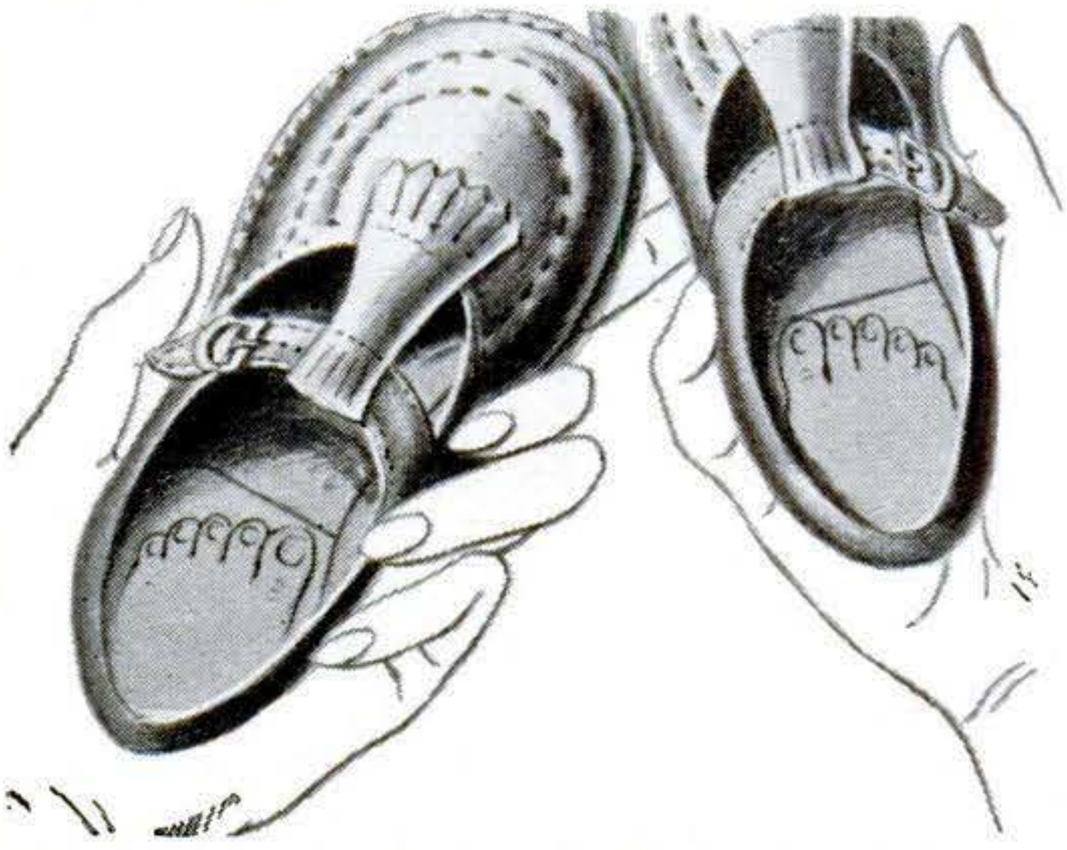
Tube or Can

A CELLULOSE FIBRE FILLER

I'd like to see them make . . .

Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

Sockets on taillights. Then it would be a cinch to connect up the lights in a trailer or to plug in a trouble light for emergency work around the rear of the car.—*James Gaffney, Smiths Creek, Mich.*



Identifying marks in kids' shoes. Since a child learns through association, imprints of the toes in each shoe would teach them quickly which shoe goes on which foot.—*Mrs. Ruth Shrider, Ogden, Utah.*

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4 Keys to SUCCESS IN AVIATION

Through Embry Riddle Training

AIRCRAFT & ENGINE MECHANICS

1

We have hundreds of urgent requests for A. & E. Mechanics -- key men in Aviation -- from airlines, oil companies, fixed base operators, etc., both U. S. and Overseas. Training in a C. A. A. approved school is the quickest way to get ahead. Embry-Riddle students learn fast with modern equipment . . . working on live aircraft in airline-size hangars.

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Flying holds a real future for Embry-Riddle trained pilots. A quarter-century of experience with 30,000 students...the best instructors, up-to-date aircraft, superb year-'round flying weather...qualifications unexcelled anywhere. Multi-engine, instrument and horsepower ratings are also available.

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4

Pilot Mechanics who can test fly the ships they repair...executive pilots able to service their own aircraft -- airmen with dual ability are needed by aviation companies and operators. Embry-Riddle combination training offers you the most in your aviation career.

Aviation needs you now! Never has there been such opportunity for you in Aviation. Start your career *now* at Embry-Riddle -- living facilities directly on the Airport. Write today for full information and proof of job opportunities.

Authorized G. I. Training

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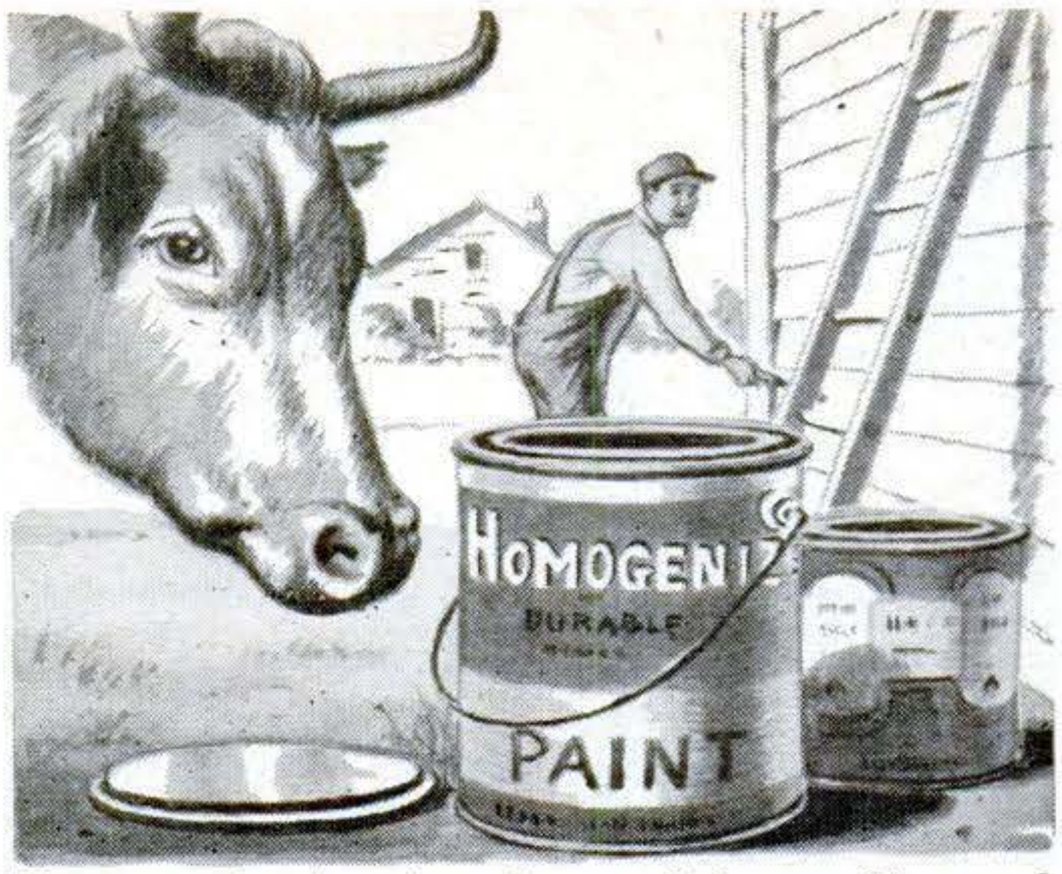
I am interested in...
- ☐ A.&E. Mechanic
- ☐ Commercial Pilot
- ☐ Engineering
- ☐ A.&E. Combined with Commercial Pilot
- ☐ Flying Mechanic

Check One { ☐ Veteran ☐ Non-Veteran

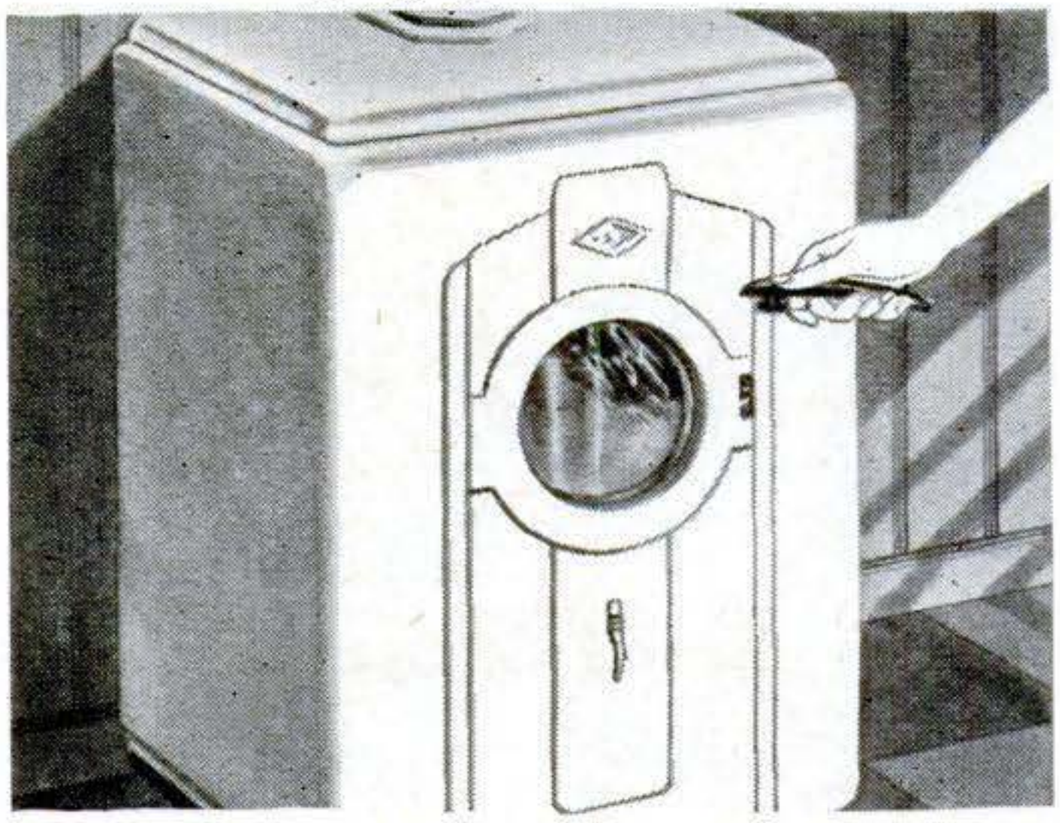
TRAIN IN MIAMI--AIR CAPITAL OF THE WORLD

I'd like to see them make . . .



Homogenized paint. It certainly would speed up work if paint were permanently mixed so you didn't have to stop from time to time to stir it. It's done with milk; why not paint?—*Edward Carroll, Maspeth, N. Y.*

Steel fence posts with auger ends. You could turn them down with a pipe wrench instead of pounding them with a sledge. The longer posts are difficult for one man to hold and drive. —*Francis Feck, Tiffin, Ohio.*



Removable washing-machine handles. With the door handle placed out of reach, children wouldn't be able to open the washer while it was operating, ending accidents and flooded floors.—*A. F. Wilson, Galt, Ont.*

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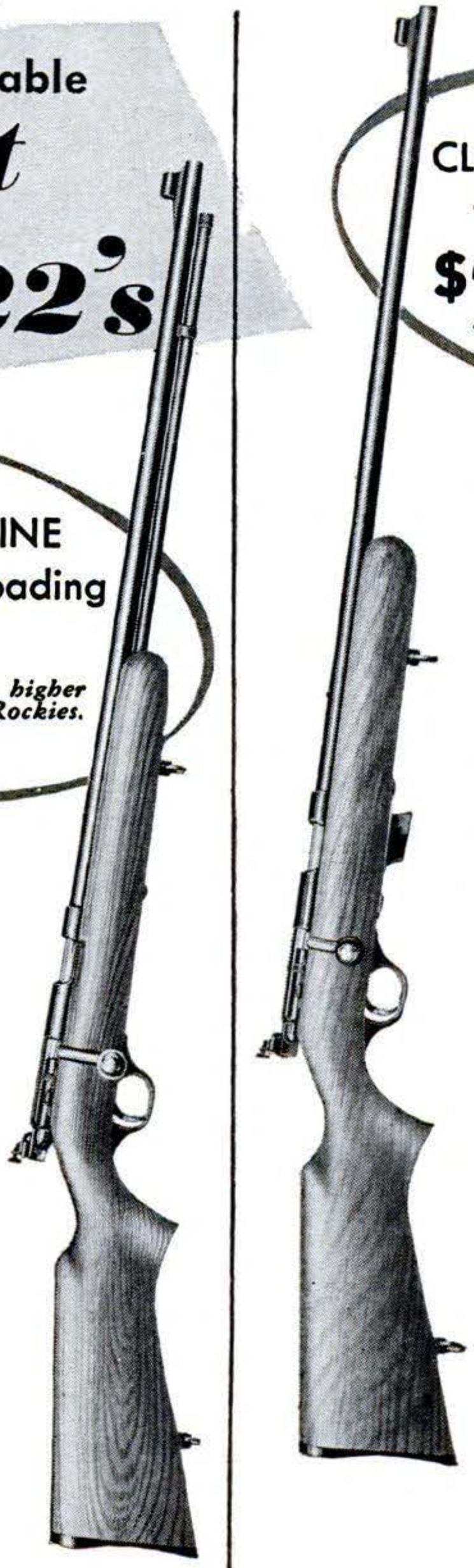
What's Your choice?...

of these sturdy, dependable

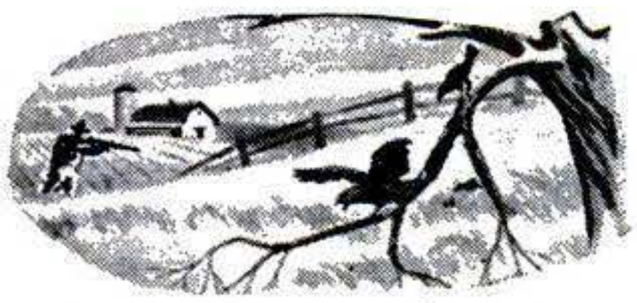
Low-Cost Marlin .22's



TUBULAR MAGAZINE
18-25 shots on one loading
$26.95*
**Price slightly higher west of the Rockies.*

MARLIN MODEL 81-DL

Shooting efficiency, with *least* fuss and bother! Magazine holds a load for a full day's hunting. Patented non-jamming feed. Shoots .22 short, long and long rifle cartridges—regular and high speed without adjustment. Quick-release trigger—self-cocking action—side ejection—Off and On safety—American walnut stock. Available with peep sight or open sights; sling strap swivels.



Unbeatable for pests and vermin...owls, rats, hawks and crows, the 81-DL carries up to 25 shots.

CLIP MAGAZINE
for rapid fire
$22.90*
**Price slightly higher west of the Rockies.*

MARLIN MODEL 80-DL

Whale of a value—this man-sized .22 repeater! Ready for instant action on vermin or small game. 8 rapid-fire shots to get 'em, no matter how fast they run. Quick-release trigger—self-cocking action—side ejection—Off and On safety—American walnut stock. Available with peep sight or open sights; sling strap swivels. More sport for your money with Marlin's 80-DL!

Marlin's 80-DL is a sure getter of woodchuck, raccoons, rabbits and other fur-bearing game.

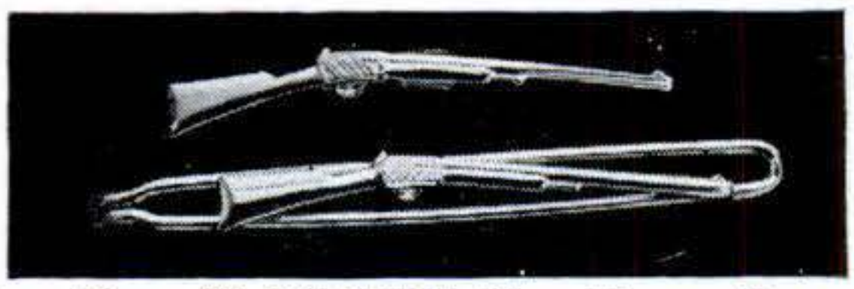
BOYS!

THE MARLIN FIREARMS CO. • NEW HAVEN, CONN.

Be a ranger. Write Sportsmen's Service Bureau, 343 Lexington Avenue, New York, for FREE booklet.

NEW Marlin Catalog, with complete specifications, now available. Send 10 cents to Dept. 59, Marlin.

SPORTSMEN'S SET—collar and tie clasp—real jewelry, richly gold-plated Yours for only 50¢ with box top of Marlin Blades; 25¢ with 3 box tops. Address Dept. 59, MARLIN, New Haven, Conn.



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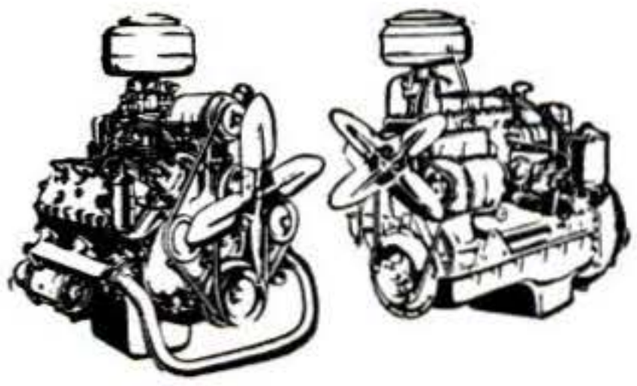
Drive a FORD and Feel the DIFFERENCE

First time you drive the great '49 Ford, you sense immediately the new Ford "feel"—a feeling of handling ease and true control that's a revelation! It goes all the way through the car—brakes, engine, springs, frame, body, steering—to give you driving ease in three big elements of motoring pleasure.

First . . . there's the feeling of positive, effortless *control* that comes from Ford's new finger-tip steering with symmetrical linkage and large worm and roller gear. Steering ratio has been increased nearly 10% to reduce steering effort.

Second



. . . these new Fords have a feeling of *responsiveness* that's outstanding — satin-smooth acceleration, power to spare in both the new 100 h.p. V-8 and 95 h.p. Six. Only Ford in its field gives this power choice!

Third . . . the feeling of *safety* and *sureness* that comes from such Ford features as "Lifeguard" Body of heavy gauge steel . . . body and frame combination 59% stronger . . . "Magic Action" King-Size Brakes 35% easier acting.

There's a NEW Ford in your future

Why not see for yourself . . . take a ride in the new Ford and feel the difference!

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PS
The Voice of Science

The Truth About "Experimental Animals"

DO you like dogs? Then you should read the article, "Science Tries You Out On the Dog," on page 151. Not only does it tell you some things about dogs nobody knew before; it will also give you an idea of what animal experimentation is all about.

You should know that your liking for dogs is lending silent support to an organized campaign against the use of experimental animals. Your sense of human decency is being used by a few willful people to threaten anyone who questions their motives. These people are crazy about dogs. Literally crazy in some extreme cases, where it isn't that they love dogs—but that they hate humans.

Over the years, these self-styled antivivisectionists have tried to make animal experimentation synonymous with cruelty to animals. They would have you believe that a medical scientist counting a cat's heartbeats, or painlessly killing a rabbit, is less human than a doctor counting your heartbeats, or a hunter shooting a rabbit.

It does no good to remind these people that somebody stuck a pig so they could enjoy a slice of its flank when cooked with an unhatched living fowl called an egg. Or that every child, newly vaccinated, is by their definition an experimental animal. Or that plasma, insulin, and penicillin could not have been developed without experimentation on many animals—including men. It does no good to get mad at the antivivisectionists. Because they are truly sick people. As sick as the child in pain who strikes you. Or the poor, frothing dog that bites its own master.

But if you know that the meddling of the antivivisectionists is seriously slowing medical science and the training of tomorrow's doctors, perhaps you will dare to deny them the use of your decent sympathies in their sorry business.

I can tell you that two-thirds of our best medical schools report being badly hampered by antivivisection activity. In one university, training in the "blue baby" operation has been halted. Others say that all their vital research is handicapped at the same time that starving, homeless dogs are slaughtered in city gas chambers. Some of our leading medical scientists have been abused and threatened. And at least one has been shot at in his own home by a complete stranger who was a confessed antivivisectionist.

But I must warn you that whatever you say in the cause of science, or in question of the righteousness of the antivivisectionists, will bring down on your head such wrath as you thought reserved for the torturers of Buchenwald.

Every scientist laboring to understand disease, even at the risk of his life, knows such showers of abuse. Every editor has seen samples of the saddening outpourings of such people. I expect to see many more as the result of signing this plea for sanity at this time when scientific understanding of people is so important to survival.

Perry Gilkeson

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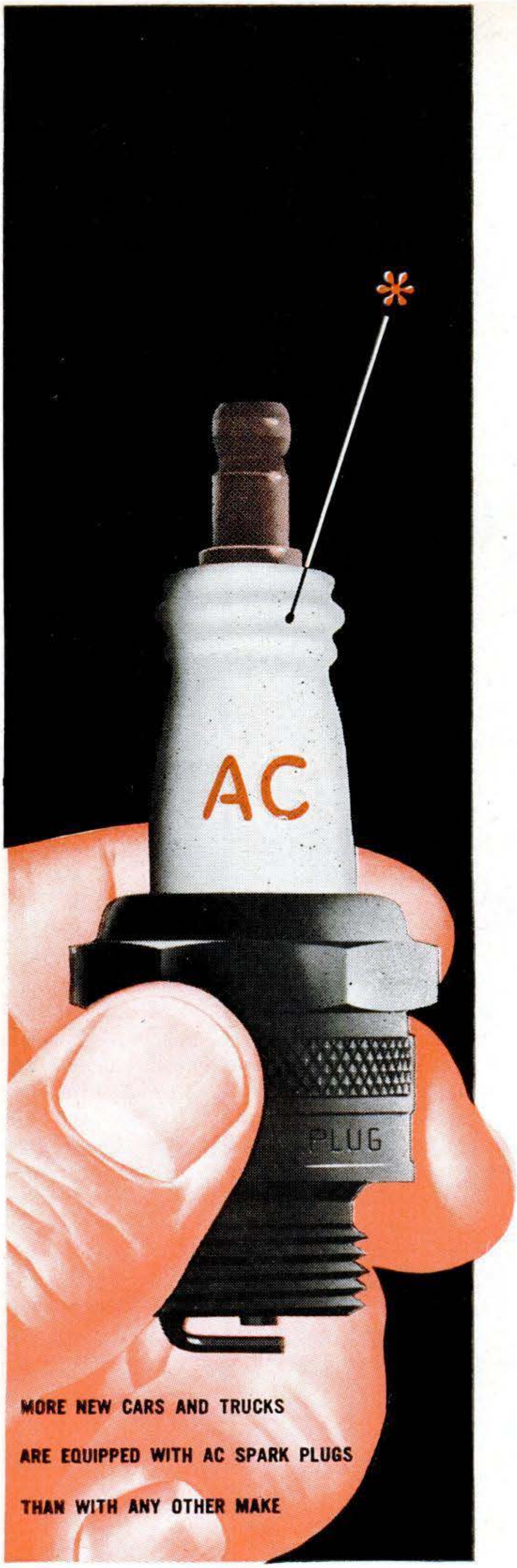
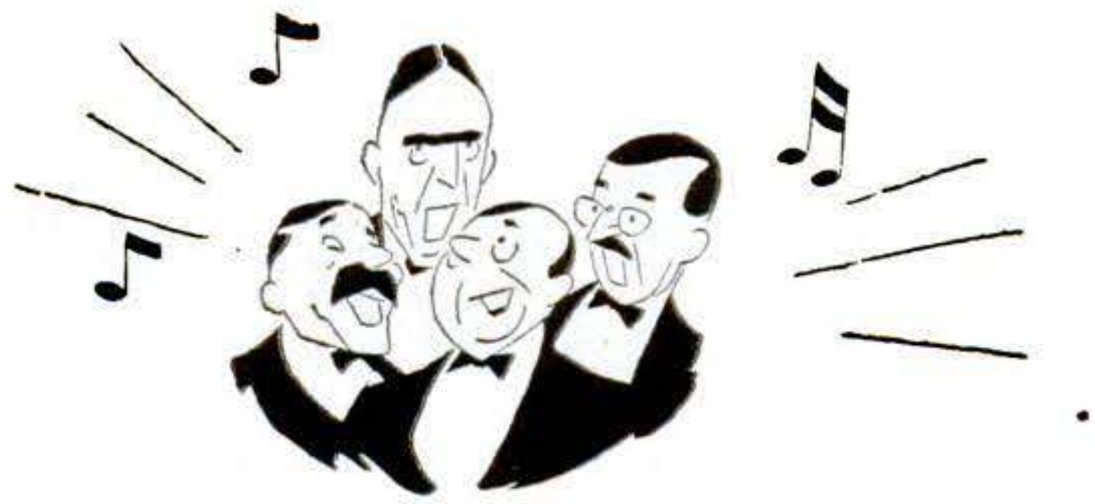


harmony...



● Harmony under the hood. Today's AC Spark Plugs, with patented Coralox Insulator,* are always in tune with your engine . . . whether it's cold or hot . . . loafing or under heavy load.

They surpass all previous spark plugs in their ability to fire steadily under a wider range of operating conditions.

They remain efficient through substantially longer life.

If you want your engine to sing a sweet song of smoothness and power, get a set of new AC's today.

AC SPARK PLUGS

BUY WHERE YOU AC SERVICE SPARK PLUG SEE THIS SIGN

* AC's patented processes make this the finest insulator in spark plug history. Improved electrical insulation, no matter how high the temperature. Better heat conduction. Maximum resistance to heat shock. Less fouling, harder, stronger, longer-lived.

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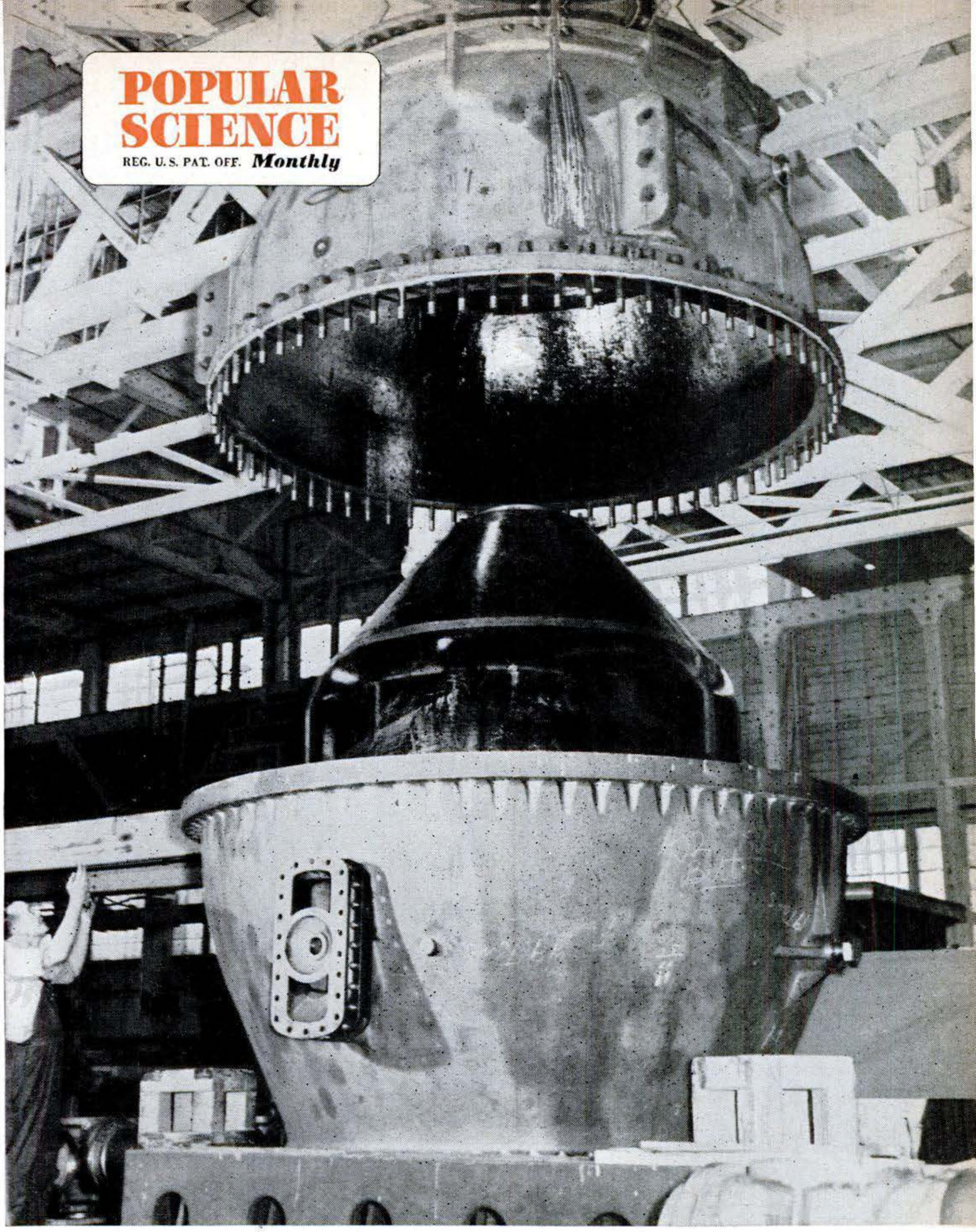

This Is a Needle Valve . . . It's several hundred times bigger than the one in your carburetor, but it works the same way. This one will regulate the flow of water from the Friant Dam, near Fresno, Calif., into the Madera irrigation canal—up to a million gallons a minute at a velocity of 63 feet a second. The cone-tipped needle alone weighs 10 tons; the nozzle, shown being lowered into place, 14 tons; the lower valve body, 86 inches in diameter and containing the electrical control mechanism, 17½ tons. Westinghouse built the parts at Sunnyvale, Calif., for the U. S. Bureau of Reclamation.

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CHOOSING THE RIGHT SCREEN SIZE

How big the viewing screen of a television set should be depends on the audience it must entertain. This chart shows, for various screen sizes, the number of people who will get a clear, undistorted, comfortable view of the picture. (Actually several more would be able to see reasonably well.)

$100

3-inch tube is best seen from distance of 13½ inches.

ONE PERSON ONLY

$200

7-inch tube can be watched comfortably from 33 inches away.

TWO PEOPLE

$325

Optimum view of popular 10-inch size is at 48 inches.

THREE PEOPLE

$400

12-inch tube permits viewers to sit 57 inches away.

FOUR PEOPLE

$650

16-inch size of projection screen gives comfortable view at 96 inches.

AUDIENCE OF SEVEN AND POSSIBLY MORE

donovan

Buying a TV set? Here are some practical suggestions to help you decide what you want for how much.

Cover drawing by Reynold Brown

What You Want to Know About Television

By Carl Dreher
Drawings by Jere Donovan

"How big a set should I buy?"
"How can I tell what's a good buy?"
"Should I install it myself?"
"How about the antenna?"
"Where should I put the set?"
"What about fire and shock hazards?"
"What's the best place to buy a set?"

THESE are the questions people are asking about television. Last year a novelty, the galloping postcards now threaten the automobile as the center of family interest. Grownups stare respectfully at moth-eaten movies that wouldn't pull customers in a free theater. Children are fascinated into silence. Pronged antennas, the proud badge of TV ownership, sprout like antlers from all kinds of roofs. So hungry is the public for this supergadget that sets have been sold where there are no programs whatever.

Unless you have a sales resistance for radios, cars, and gimmicks unusual among readers of this magazine, you are probably talking yourself into TV right now. I won't even discuss what you can see in the little flicker-window. That would be like asking grandpa with the goggles where he could go in his merry Oldsmobile. As a new fan for old vaudeville myself, I know you want to talk about the machine, not the scenery.

Let's suppose you have stopped shuddering at the price tags. You know that TV is a three-figure dish even at the low end of the menu. You want steak—the question is, how thick? Or, rather, how wide? Incidentally, a "7-inch tube" refers to the *diagonal* of the picture, not the width.

Looking at TV is like reading this page. For one pair of eyes, it's plenty big enough. But if you want two people to look at the same time, that comes to four-eyes wide; so you'll have to move *back* from the screen and make the picture *bigger*. Two heads, it seems, are bigger than one.

To decide how big a screen you want, count your money (in $100 bills) on one hand, and your heads on the other. At present prices, a good rule of thumb is $100 a head. That's the price of a pass to your private theater.

Charted on the opening page are the common screen sizes (tube diameters) and the number of viewers each can serve well. Calculations are based on six times picture width, for good viewing, within an angle 25 degrees each side of center. Standees and floor-squatters would increase the potential audience, but not the comfort.

On this basis, the little 3-inch $100 job, with a screen the size of six postage stamps, can hardly accommodate a crowd of two people. Even a 7-inch set is on the intimate side. And nothing less than a 10-inch screen

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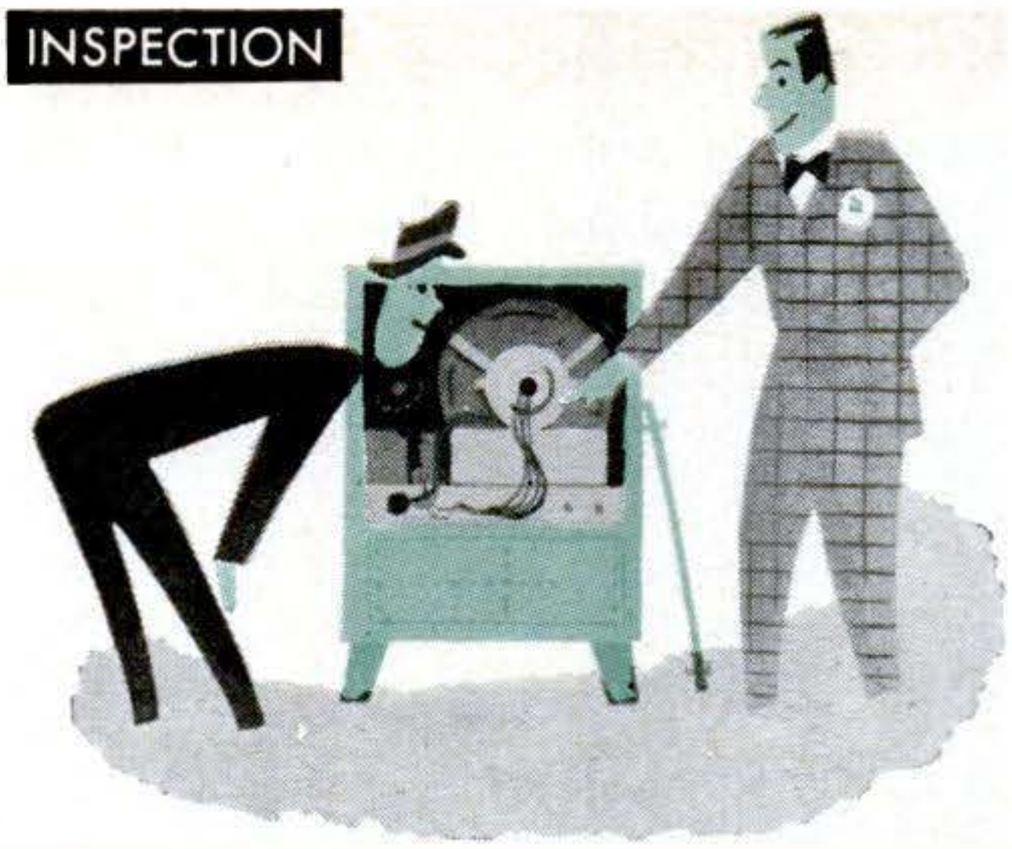
WHERE TO BUY

Whether you pick a television shop that's large or small, in your own locality or another city, make sure it will stand behind its wares. Don't be afraid to try several places before deciding.

INSPECTION



Look closely and ask questions. If the salesman doesn't know the answers, make him find out—or look for another salesman who does. See the text of this article for important points to check.

will keep the kids literally out of your hair.

The 10-inch set is the big seller today because it fits the average family with one or two children. If you want to run a small television theater for your friends, get the projection set with a 16-inch picture or, if you can afford it, the more expensive, equivalent direct-view job, which gives a better image. Actually, either of these will accommodate, in reasonable optical comfort, more viewers than the chart shows.

All viewing tubes, whether 3-inch or 20-inch, make their pictures out of 525 individual lines (like the "dots" in the pictures here) and theoretically all might be capable of equal sharpness. But the bigger sets may produce better images, because they have improved circuits and more tubes, giving a sharper, clearer, steadier picture, as well as better reception on weak stations or if you live far from the transmitter.

Now that you have settled on *screen* size by counting noses and dollars, consider *set* size. Cabinets vary like boxes of soap flakes with the same contents. Your best bet, if you buy television is to buy *television only*. Don't go overboard for combination radio-TV-long & short record-player outfits complete with home-movie screens and electric organs. If you want these things, get them separately. TV is a swift-

Smallest—and cheapest—television receiver now on market is this 3-inch Candid®, made by Pilot Radio Corp. It is priced at about $100.

Set below has a 12-inch picture tube. GE's new model 814 has 18 tubes and aluminum-backed viewing screen. The price in the East is $389.50.

Most popular size is 10-inch, made by most manufacturers for $325 up, depending partly on cabinet. Westinghouse, below, costs $400.

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HOME DEMONSTRATION

Ask for a home demonstration, particularly if you buy your set in a store far from your neighborhood, before closing the deal. Quality of reception is very different in different areas.

SERVICE

A highly complex electronic gadget, a television set is not easy to repair. Unless you are an expert and like to tinker with such things, the seller's one-year guarantee is worth its cost.

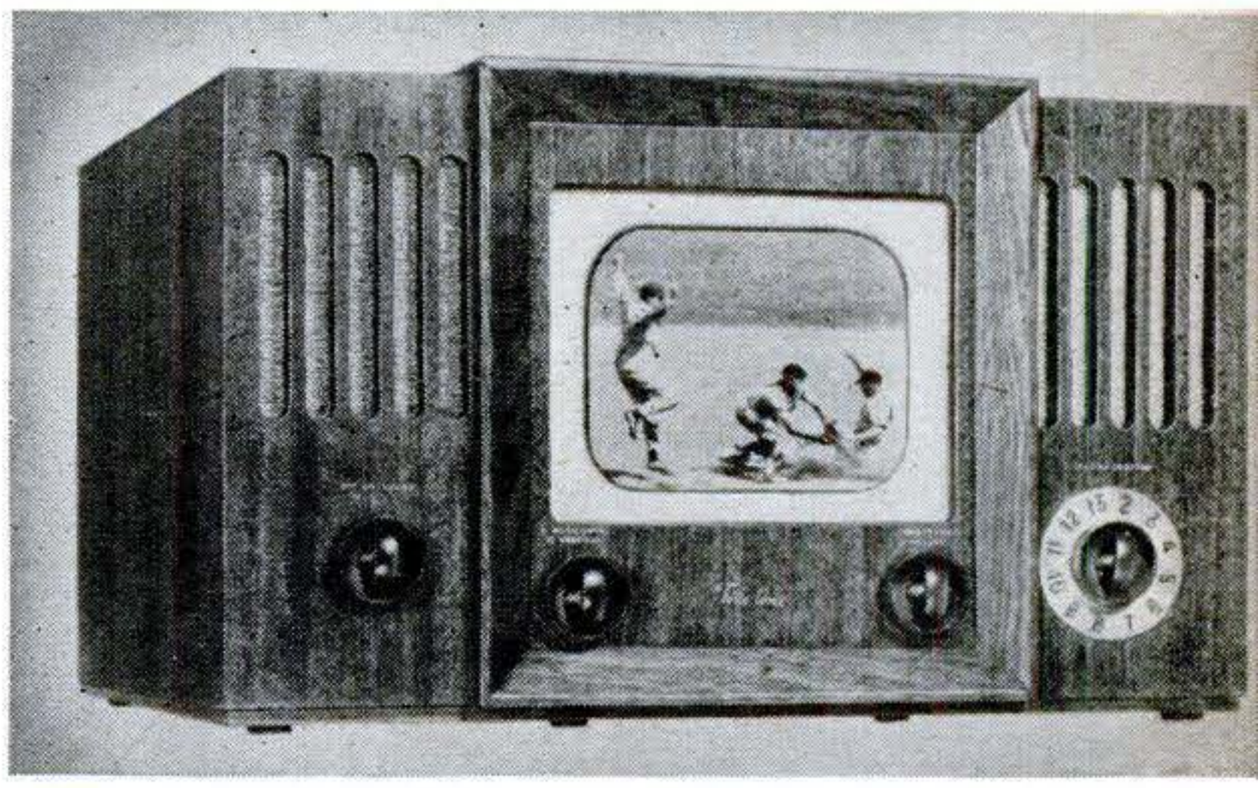
changing piece of equipment: today's biggest screen will seem cramped in a few years. The less other stuff you have glued onto your present set, the freer you'll feel to improve it later.

And another point: It is practically certain that television will go up into the higher frequencies before very long. Some areas will not be affected; in others, sets will have to be adapted. This may be a factor in how much you want to spend on one now.

Settled on screen and set size, and thereby price range, you now consider makes. This is a tough one. A young business, quick with promise of profit like the young automobile business, TV promotes a lot of nameplates. Many you know as old friends in radio or appliances. Others are newcomers. But all use the same tubes and many the same basic components. Again as in automobiles, the reputation and service facilities of the dealer are important.

With a lot of good money on the line, you have the right to take your time and ask questions. Look over the floor samples for general workmanship. In demonstrations, check into these significant points:

Sharpness. Tune in a station that is broadcasting its test pattern—a chart made up of lines and circles that is put on the air between programs or when there are no



Seven-inch set permits more than one person to watch show, sells for around $200. Tele-tone's model (above) operates on either AC or DC.

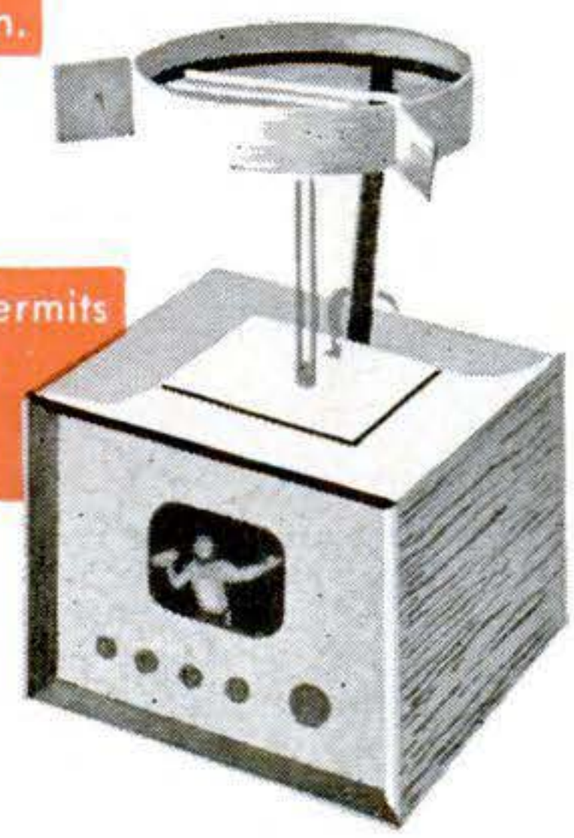
For de luxe entertainment, Du Mont makes the Westminster® combination below with 24-inch direct-view screen. It costs about $2,500.

Projection set gives pictures as big as largest direct-view tubes but not quite so clear. RCA combination model below costs about $1,500.

Roof-mounted folded dipole is most popular and very sensitive.

Outside-the-window type eliminates roof crowding in apartments.

Lead-in or other wire folded to length under rug works near station.



Portable antenna permits moving set around but lacks sensitivity of outdoor types.

programs. (It is difficult to judge picture quality from a regular program picture.) Adjust the set for the best image, and then look closely at the black-and-white lines that converge toward the center. *The farther in they show up clearly, the better.*

Contrast. The inner black ring of the test pattern, circling the station call letters, should be really black, while the successively lighter gray rings should be obviously different shades of gray.

Drift. Watch the test picture after the set has been on at least 15 minutes, to see if it holds its sharpness. If the set requires frequent retuning, be suspicious.

Controls. Some receivers have semi-automatic tuning—the picture stays sharp when the station selector is switched from one station to another. This eliminates a lot of knob-fiddling but means you'd have to go inside the set to adjust it.

Number of Tubes. In general, the more the better.

Number of Stages of Amplification. Again, the more the better. If the salesman doesn't know, ask the serviceman.

How to Check Sensitivity

Sensitivity. Find out—from the salesman or instruction book—the sensitivity of the set (measured in microvolts per meter) on each channel. It should be at least as great as the field strength *near your home* (also measured in microvolts per meter) of the transmitter using that channel. (Most transmitting stations will tell you their field strengths in your locality if you write them.) You can make a visual check on sensitivity by simply tuning in each station.

Audio System. Listen critically to music—live rather than recorded, if possible.

Cabinet. A television set is a piece of furniture, and a prominent one. Make sure the design will be pleasing in your home.

Home Demonstration. Usually a set will work better away from the interference caused by traffic, doctors' equipment, and neon signs in the business district. But sometimes the reverse is true, especially if you live far from the transmitters or in the "radio shadow" of a hill or building. Ask to see the set operating in your home. If the dealer refuses—often he will—insist on a money-back guarantee.

If you are not fond of electronic tinkering, buy your set *with* installation and a one-year guarantee, which costs 20 per cent of the purchase price. And ask whether that cov-

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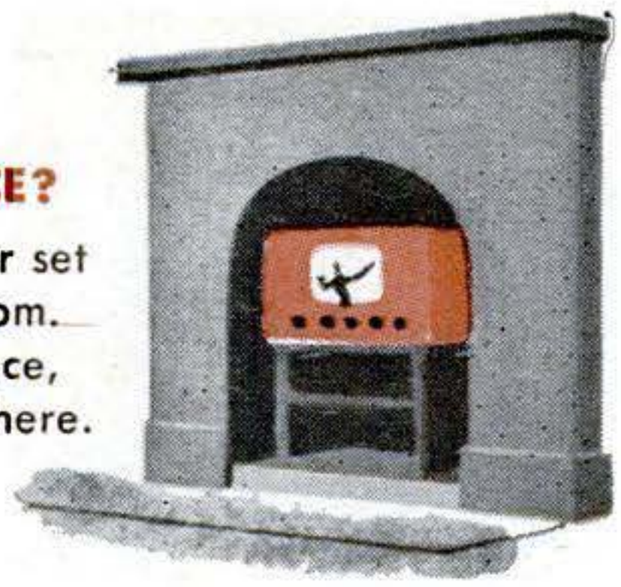
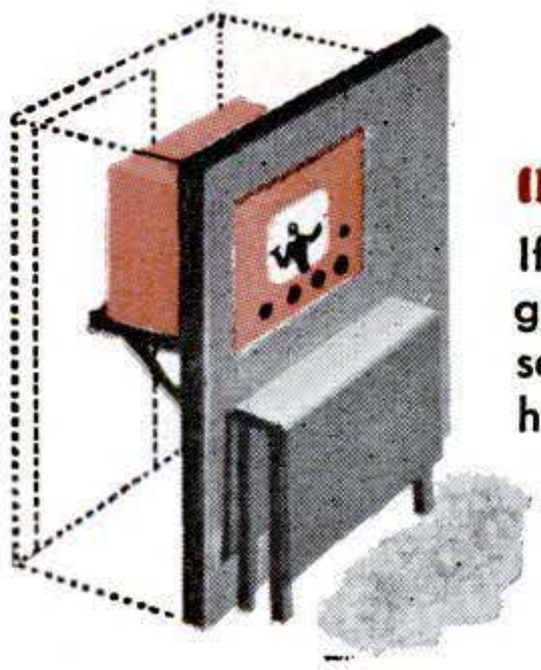
WHERE TO PUT IT



IN THE FIREPLACE?

Obvious location for set is focal point of room. Often this is fireplace, and some are put there.

The dining room makes a good video theater, since it has easy-to-move chairs and a big table for refreshments and ash trays.



IN THE WALL?

If you own your own home, good solution is to mount set flush with wall that has closet behind it.

AVOID GLARE:

Visibility of daytime programs may be affected if set faces windows.

WHAT FURNITURE?

Place comfortable chairs close enough to set; keep lamps out of direct view.

ers the picture tube for a full year, or only 90 days. And how about an option to renew the guarantee at the end of the year?

Yes, it is possible to install and service a television set yourself. It is even possible to build a set from available components or complete kits. But just because you were a hot-shot with a soldering iron in your radio days, don't think TV is easy meat. Television is a lot more than visible radio. It is more like *radar*—which was the maintenance terror of the Army and Navy.

Practically all TV antennas are based on the simple dipole—two arms extending at right angles to the supporting mast. Together the arms measure half the wavelength of the band to be received. There are many modifications and extensions of the half-wave dipole. Some of these are reflecting rods, folding bars that double back on themselves like trombone slides, and multiple units or arrays to favor particular stations or portions of the band. Usually separate units are needed to cover the present low band (channels 2 to 6) and high band (channels 7 to 13).

Signals are piped down from the antenna through twin leads that are matched to the receiver, or through the more expensive coaxial cables that reduce signal loss.

You may be able to get by with an indoor aerial if you live in an area where the transmitter lays down a powerful signal. This can be of plastic-insulated twin lead-in wire or almost any sort of wire. A more elaborate aerial stuck out of the window is better, though. And a roof aerial picks up still more signal and gives better protection against "ghosts," or reflections. But then, if you live in an apartment house, you have the landlord to reckon with.

Among the accessories that you may

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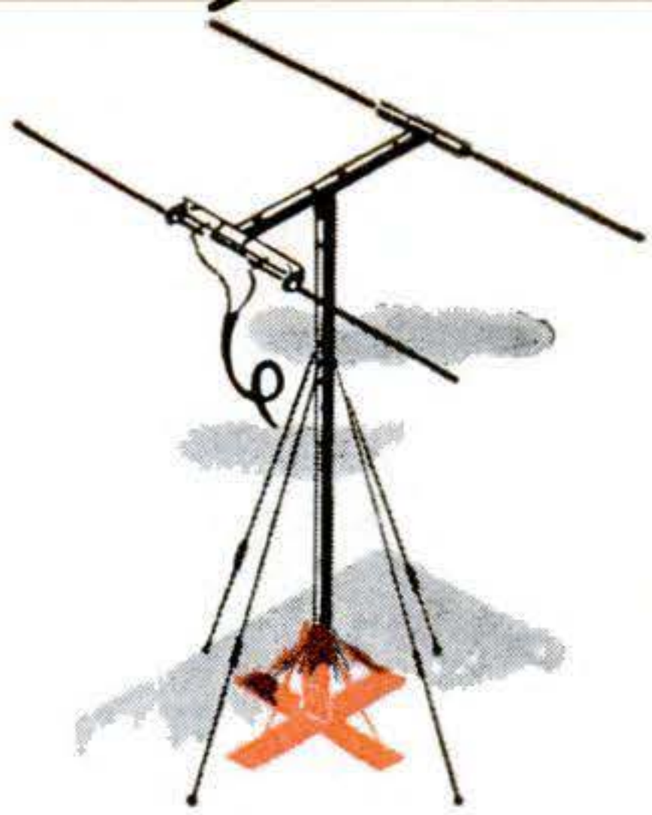
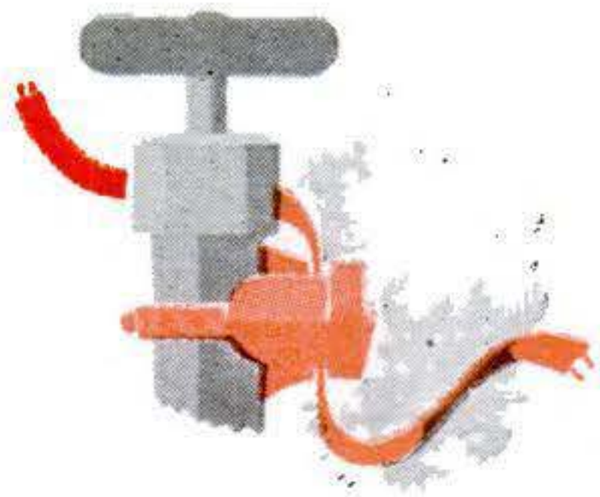
SAFETY

Closely packed components make sets run hot, may cause fire if vents are blocked.



Loose antennas are a hazard. Make sure yours will stand up under winds, ice.



Special television lightning arrester in lead-in wire is required by electric code.

wish to consider are enlarging lenses, filters, and boosters.

Lenses will give you a larger picture, but you'll have to sit almost directly in front of them. Before buying one, make sure it won't interfere with the tuning knobs. Lenses may give an impression of a rounded screen; if you don't mind this, or appearances, a lens may be a good investment, especially for a 7-inch set. Some sets with built-in lenses to produce 60-square-inch pictures from 7-inch tubes may be good buys. But the picture produced is not the equivalent of an unmagnified picture from a 12-inch tube.

Filters that fit over the screen may improve the picture under some conditions. They provide color discrimination and improve contrast—with some loss in light. This usually can be made up by increasing the picture brightness. Filters also improve the picture's visibility, because room light has to pass through the filter twice, while the tube's light passes through only once.

A booster—an extra, separate stage of radio-frequency amplification – may help, particularly with a small set far from the transmitter. To find out, try one.

Before you buy your set, decide where you are going to put it. You may be able to mount the set in a wall or bookcase that has a closet on the other side.

Perhaps the ideal place for TViewing is the dining room. This keeps the living room for living—reading, writing, cards, and talk can't stand the competition when the set is running. With TV in the dining room, you simply turn the chairs to face the set.

TV sets have some special hazards—although the Underwriters Laboratories are not too worried. With 20 tubes going, the sets put out more heat than a radio. Blocking ventilation holes behind and under the set may result in a fire. If you ever smell insulation cooking, turn off the set, pull the plug, smother the set with a rug or use a nonaqueous extinguisher.

There is no serious shock hazard with small sets; large ones should—and most do—have an automatic switch to cut off the power when the cabinet lid is lifted. But you can get quite a jolt from the picture-tube terminals, even after the set has been disconnected. If you remove the cathode-ray tube from the set, handle with care—it can explode like a big incandescent lamp. There is no danger when it is inside the cabinet, since the screen is covered with a plate of safety glass.

The roof antenna is a greater potential danger than the set itself. It should be securely mounted so that winds, snow, or ice cannot break it loose to fall on passers-by.

Where to buy depends on where you live. Generally, the *biggest* dealer *nearest* you is safest—TV isn't a car you can roll into any service station. If you are investing in a big-screen, big-money set you will gravitate to the plush salon with the most models. This may also be a good place to buy a small set. But a neighborhood dealer is handier when you have trouble after hours. He may even listen more attentively to money talking—something knocked off the list price is not unknown even today.

For accessories, kits, or assembled sets that you expect to service yourself, mail-order buying is optional. Big mail-order houses have been satisfying radio customers for decades, and they can be expected to do the same for television purchasers. END

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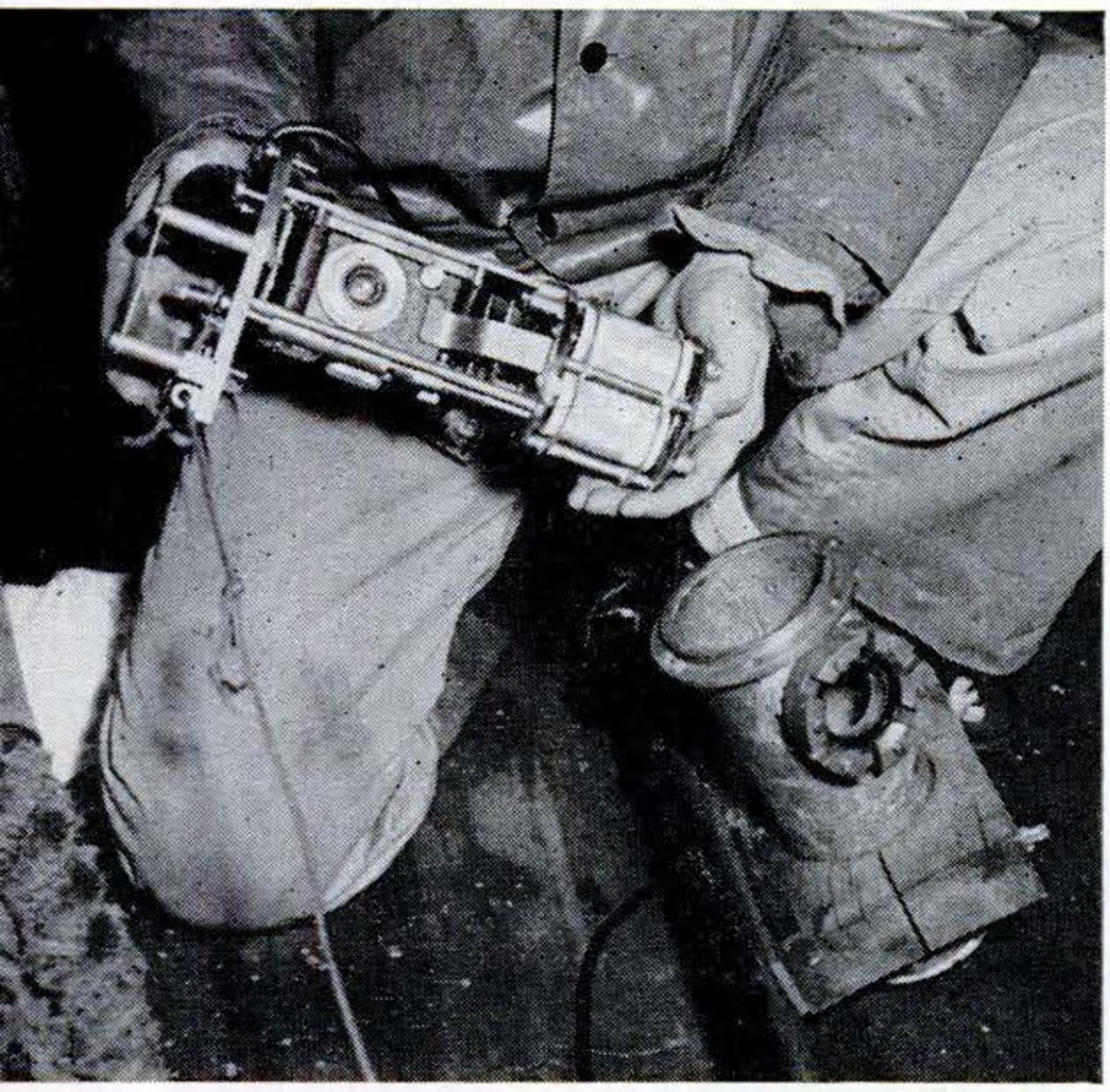
Experienced fishermen lower huge trawling net on steel cables run over idler rollers. Net is dragged behind ship for about an hour. Electric winches then haul it aboard, and the catch is counted. Knowing area covered by trawl, scientists can estimate total fish population of bank.

Counting Fish For Bigger Catch

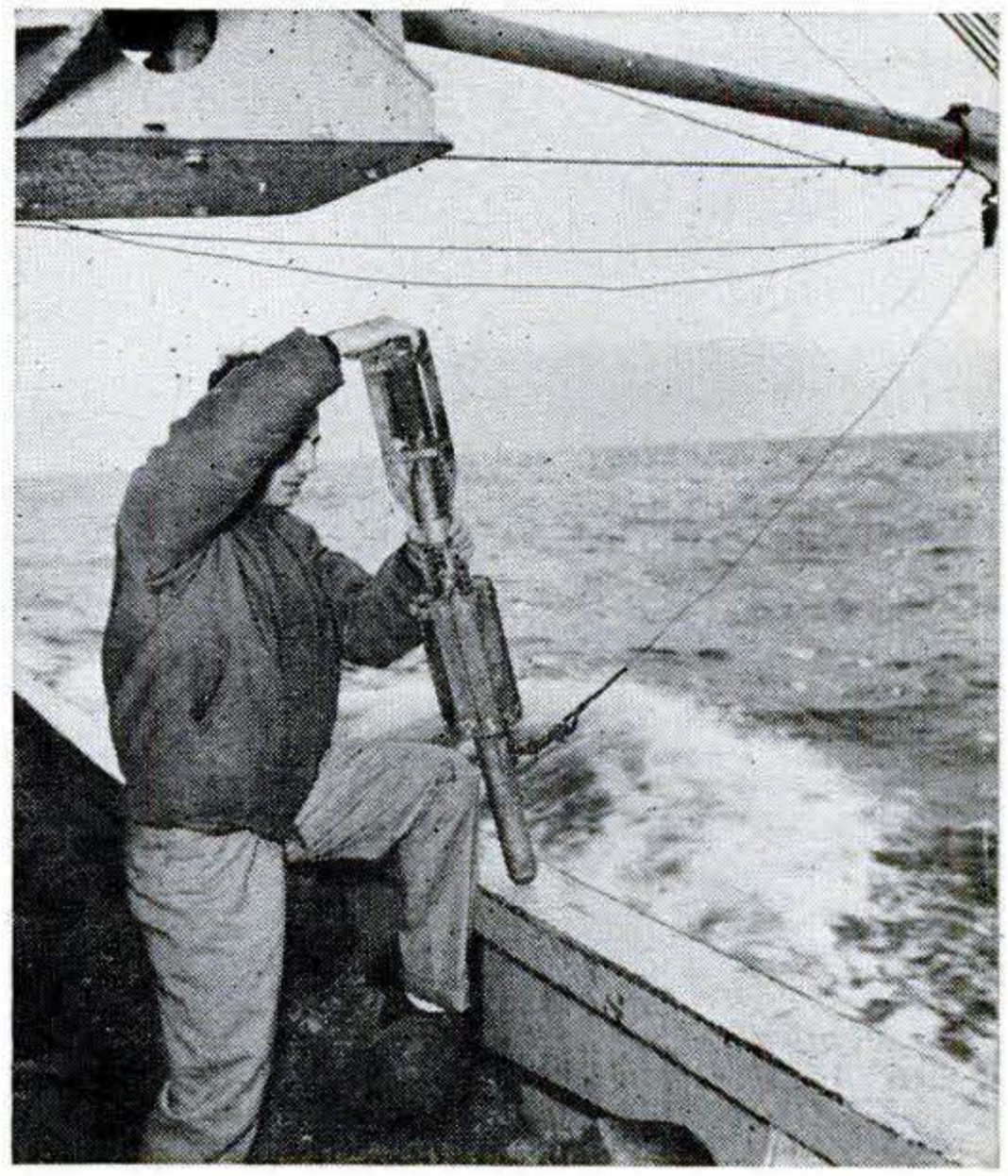
WHAT'S happened to the fish? North Atlantic fishing boats head back to port with smaller catches every year—which means you pay more for your seafood dinner. To find out why, the Government's Fish and Wildlife Service is taking a fish census.

This census is being taken, logically enough, by fishing—but from a unique fishing boat. The 179-foot research vessel Albatross III (PS, May '48, p. 166), cruising the northern banks, carries not only some plain old-fashioned fishing nets but some of the latest scientific gadgets. These explore the depths, survey the fish food supply, measure the temperature of the water, and sample it for chemical analysis.

Data from all these hasn't yet solved the mystery of the disappearing fish. Dr. William F. Royce, who heads the survey, doubts that overfishing has used up the stock or that sewage and industrial waste are poisoning the water. One guess—to be tested by further research—is that changes in the weather from season to season account for the varying sizes of the catch.



Underwater camera fits into brass case (foreground) with window to shoot through. Solenoid, operated on flashlight batteries, trips shutter at tug on cord running to ship. This also fires flashbulb in reflector (not shown) mounted on camera base but unprotected from water.



Sea sampler is lowered on measured line. It takes temperature at desired depth and, when hauled up, brings along a sample of water for analysis. Temperature-sensitive electrical wires, wound inside the tail fins, operate a stylus that scratches wiggly lines on smoked glass.

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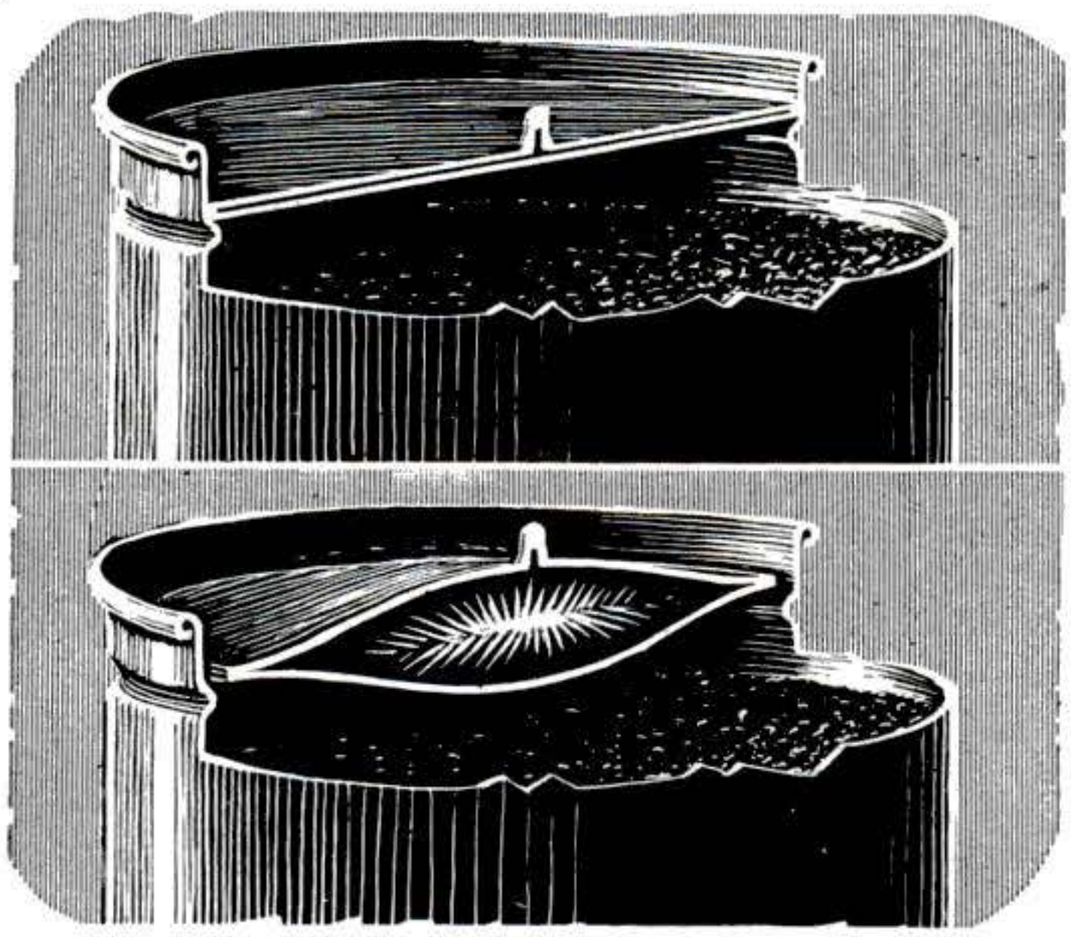
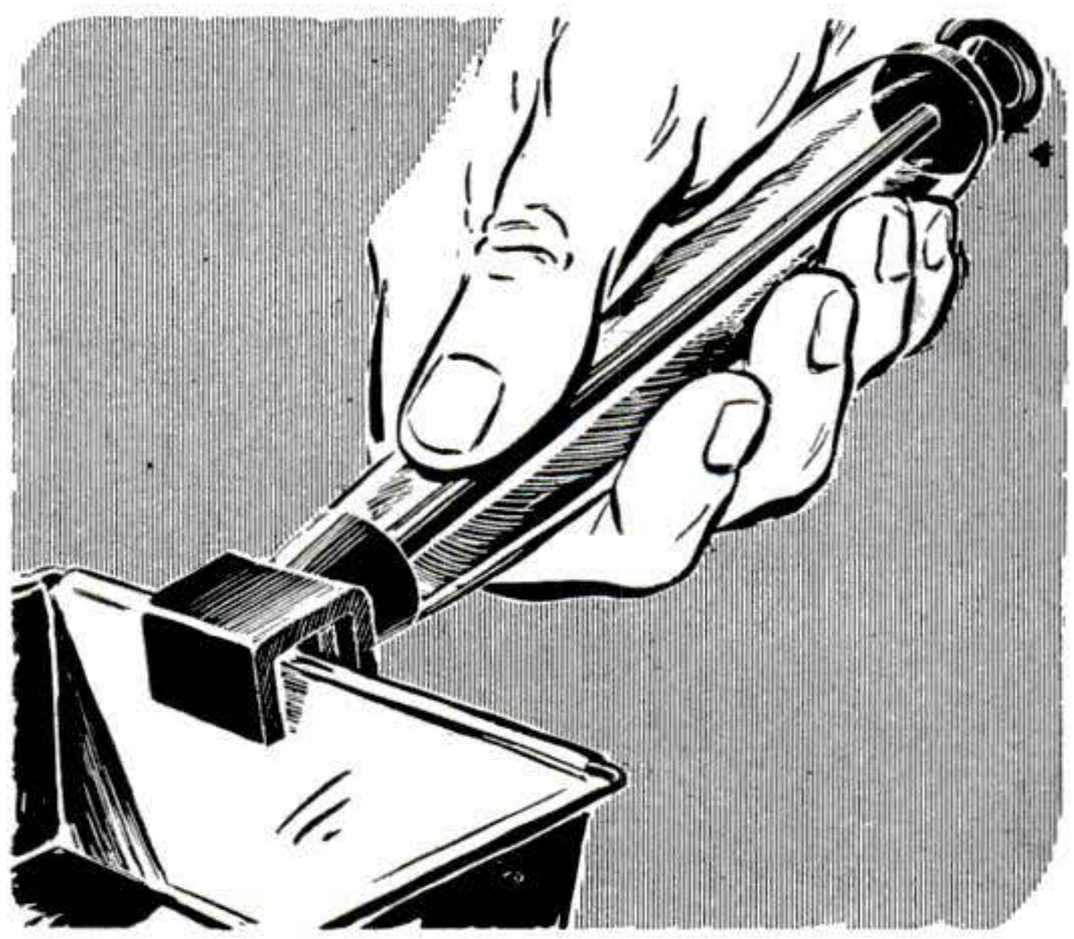
New Ideas from the Inventors

Train Light Follows Track. This locomotive headlight turns with the track, instead of shooting off to one side. A pendulum supports the light on one end of a pivoted crossarm, the other end of which is forked. On a banked curve, the pendulum remains vertical, but a fixed rod between the fork tilts with the engine (diagram), swinging the light to follow the curve. The inventor is W. Le Clair, of Martinsdale, Mont.



Can Opens Itself. Warm water is all you'd need to open the can invented by N. B. Wales, of New York. The lid is a sandwich of two metal disks with a volatile liquid in between. When the lid is heated, the liquid expands, bulging it apart. This pulls the edges away from the can, breaking the seal and freeing the lid for easy removal.



Handle Clips on Pans. Just clamp this handle onto the rim of a pot, and you won't burn your fingers on pans that have no handles or whose handles have become too hot to touch. Twisting the ring at the end turns a threaded rod running through the handle and screws it on tight. The inventor is J. B. Galliano, of Oakland, Calif.

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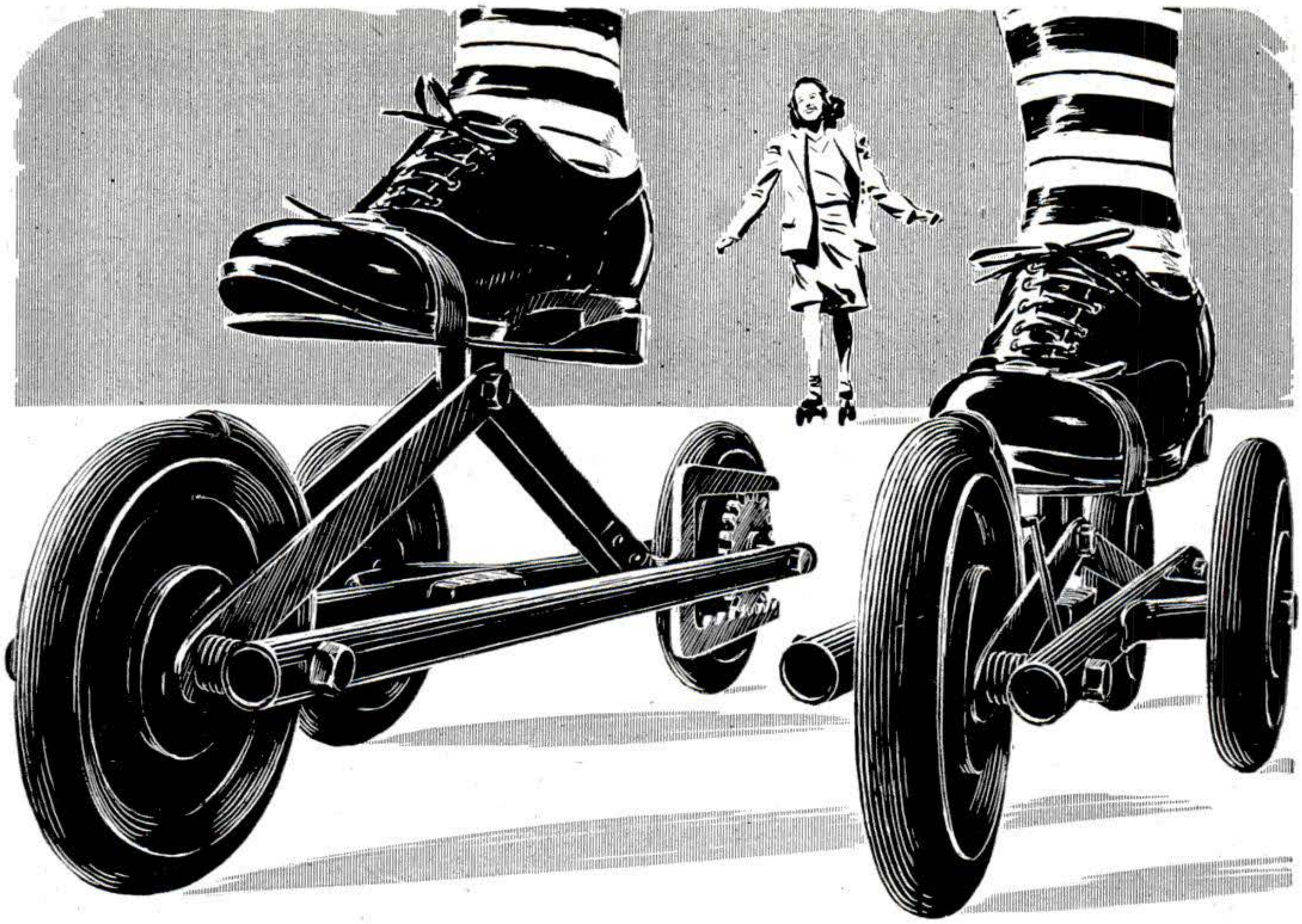

Skates Power Themselves. You wouldn't have to push these roller skates—they'd push you. Pressing down on the shoe plate slides a toothed bar along a gear wheel attached to the rear skate wheel. This turns the gear, driving the skate wheel—and the skate. At the end of each downward push, a clutch disengages the gear so the foot can be raised for the next push. The inventor is F. M. Bohler, of Hawthorne, Calif.

Cup Doubles As Stopper. If you find it hard to keep vacuum-bottle corks clean, you'll go for this cup-and-stopper combination patented by G. Keith, of Hollywood, Md. The cup's bottom is a flexible diaphragm stretched over a center post. When the cup is screwed onto the bottle, the diaphragm is pressed into the mouth.

Extra Stock Improves Aim. Greater steadiness for accurate shooting is the object of this auxiliary rifle stock, patented by H. G. Howard, of Denver. It swings out from a recess in the main stock and can be adjusted to the proper length to bring it against the left shoulder. It also lessens recoil by dividing it between both shoulders.

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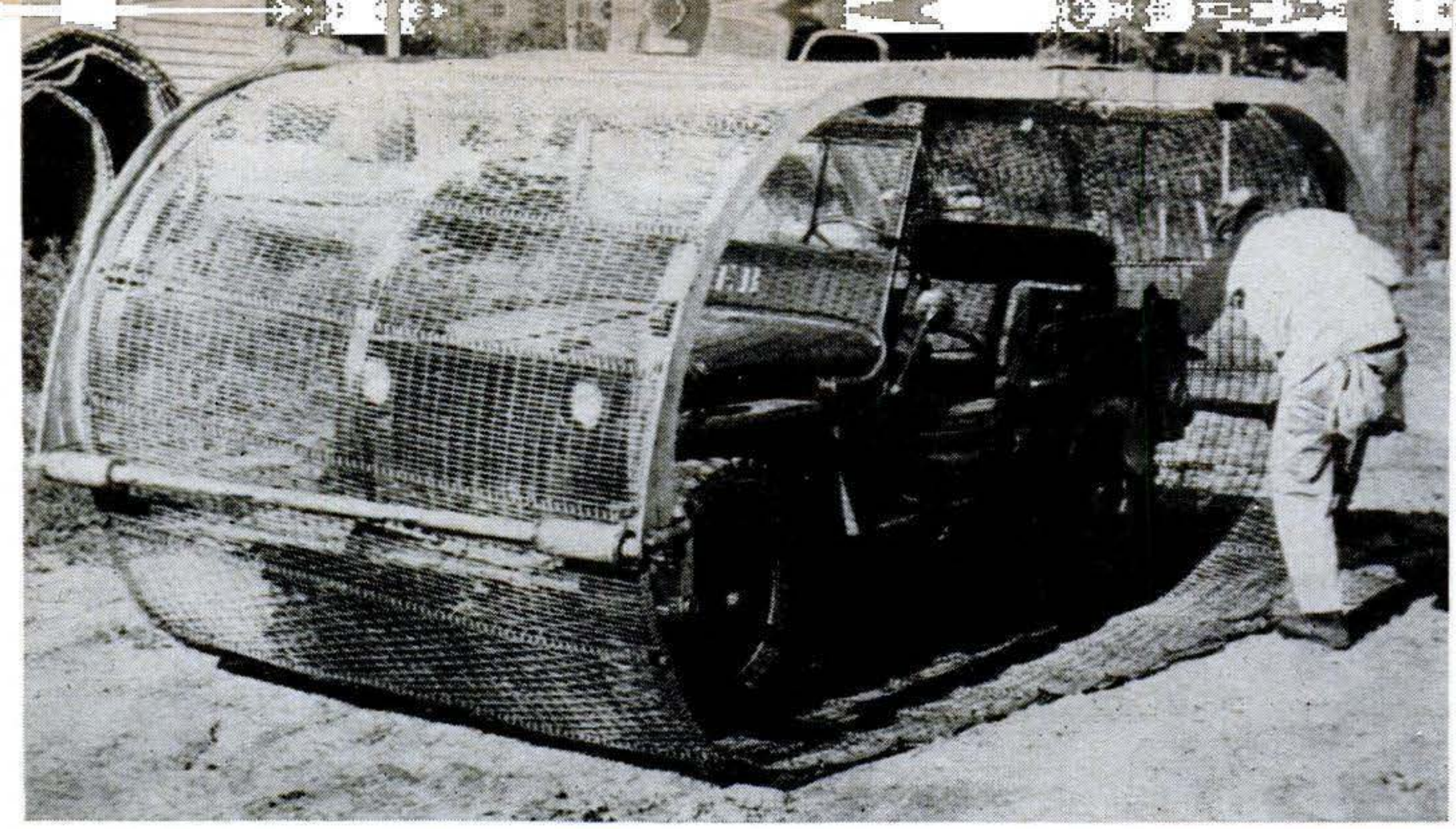

"Caged" Jeep Needs No Roads

THIS jeep carries its own road right along with it. As the jeep moves forward, an endless, cagelike band of coarse wire matting completely encircling it is rolled around under its wheels. This gives them a broad, flat footing over swamps, bogs, soft sand, and heavy underbrush. A tracklike frame attached to the jeep supports the matting on rollers overhead. The new device is being tested by the Marine Corps at Quantico, Va.

Magnet Bends Electron Beam

YOU may have seen iron filings used to demonstrate a magnet's lines of force. Here's the same thing gone modern. The curved glow seen above is actually a stream of electrons in a new electron tube developed at N. Y. U. Normally straight, the beam is here photographed as it is bent by the force of the horseshoe magnet held against the tube.

Console Cabinet Hides Ironer

LACK of kitchen or laundry space is no problem for this new Ironrite roller ironer. When not in use, its fine-wood, console-type cabinet makes it a normal-looking piece of furniture even in the living room. Closed, its top can serve as a table. Available in mahogany or blonde finish, the ironer has castered feet and retails for about $250.

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W. S. Pike, RCA engineer who helped develop electronic reader, moves its eye over text.

Reading Machine Spells Out Loud

Experimental electronic device looks at printing and says what it sees—at the rate of 60 words a minute.

By Martin Mann

PS photos by Hubert Luckett

SOME time ago, *The New Yorker* magazine satirically described the invention of a reading machine. "It is obvious," a fictional Professor Entwhistle was quoted as saying, "that the greatest waste of our civilization is the time spent in reading. We have been able to speed up practically everything. . . . But today a man takes just as long to read a book as Dante did. . . . So I have invented a machine. It operates by a simple arrangement of photoelectric cells. . ."

A simple arrangement of photoelectric cells that will read a book for you now has been unveiled by RCA researchers. The device looks at printed matter and reads it aloud, letter by letter. It sounds like a radio announcer spelling out "R-I-N-S-O."

The main trouble with this invention is that it costs a mint of money.

The reading machine grew out of research on aids for blind people sponsored jointly by RCA, the Veterans Administration, and the wartime Office of Scientific Research and Development. This work also produced the "reading pencil" (PS, April '47, p. 111), which sounds a different tone signal for each letter and is now being tested with blind hospital patients.

The pencil can read only about 20 words a minute, however, much slower than running a finger over Braille and only about a

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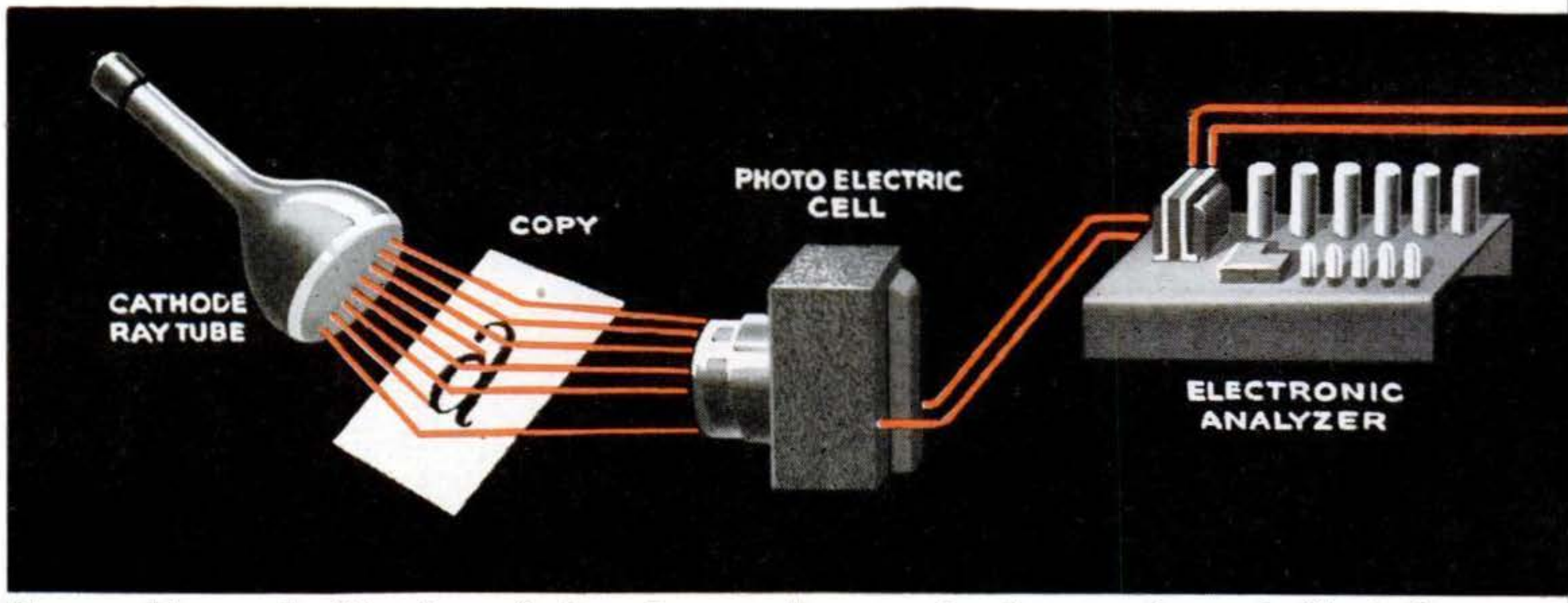


How machine reads: Electric eye looks at letter and reports its shape to electronic "brain."

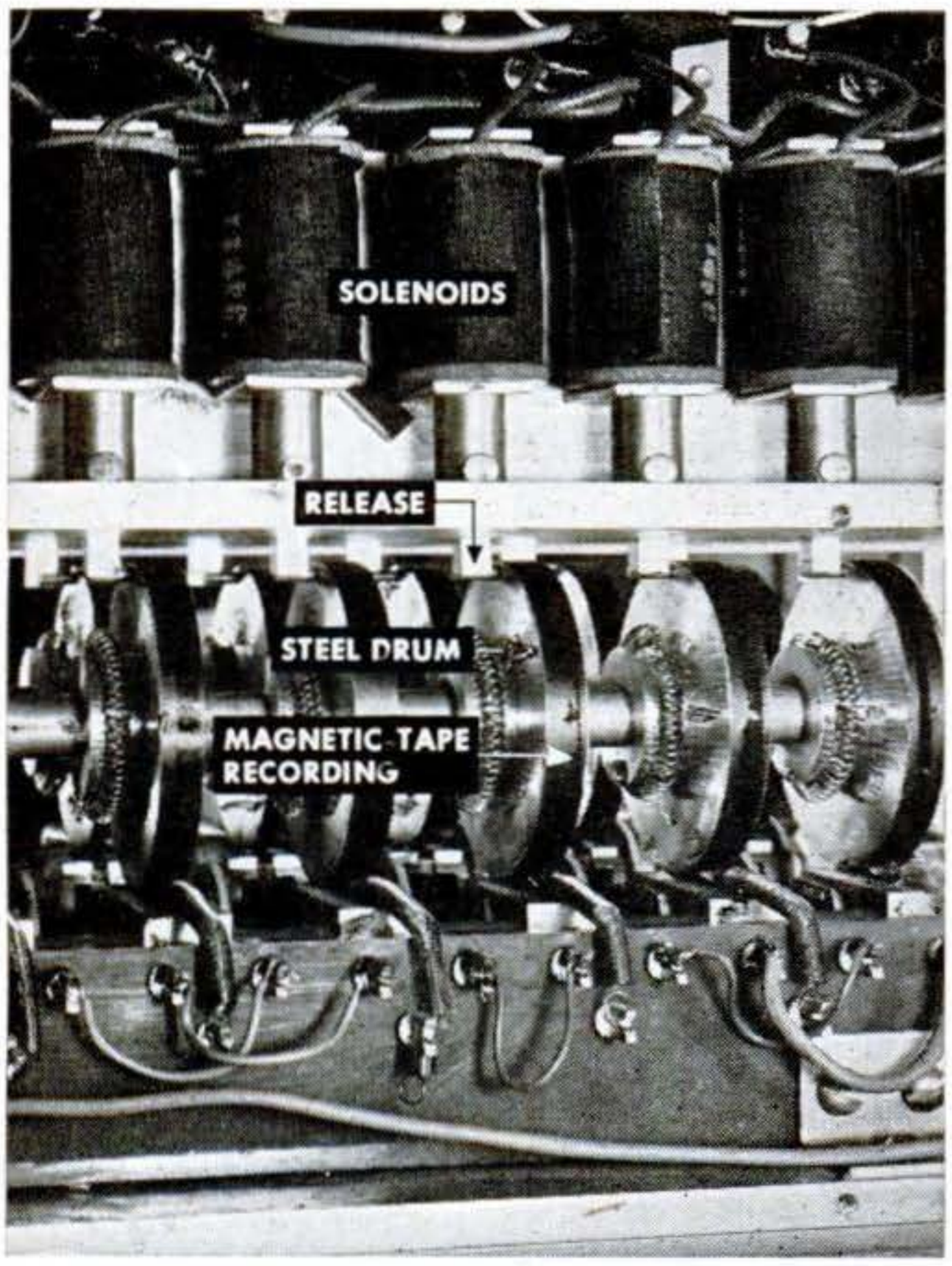
third as fast as the new machine. Both devices are purely experimental, and there are no present plans for manufacturing them.

Besides reading all 26 letters—thus spelling out any word—the new machine can read a few whole words. One could be built to read additional words by making it bigger and more complex.

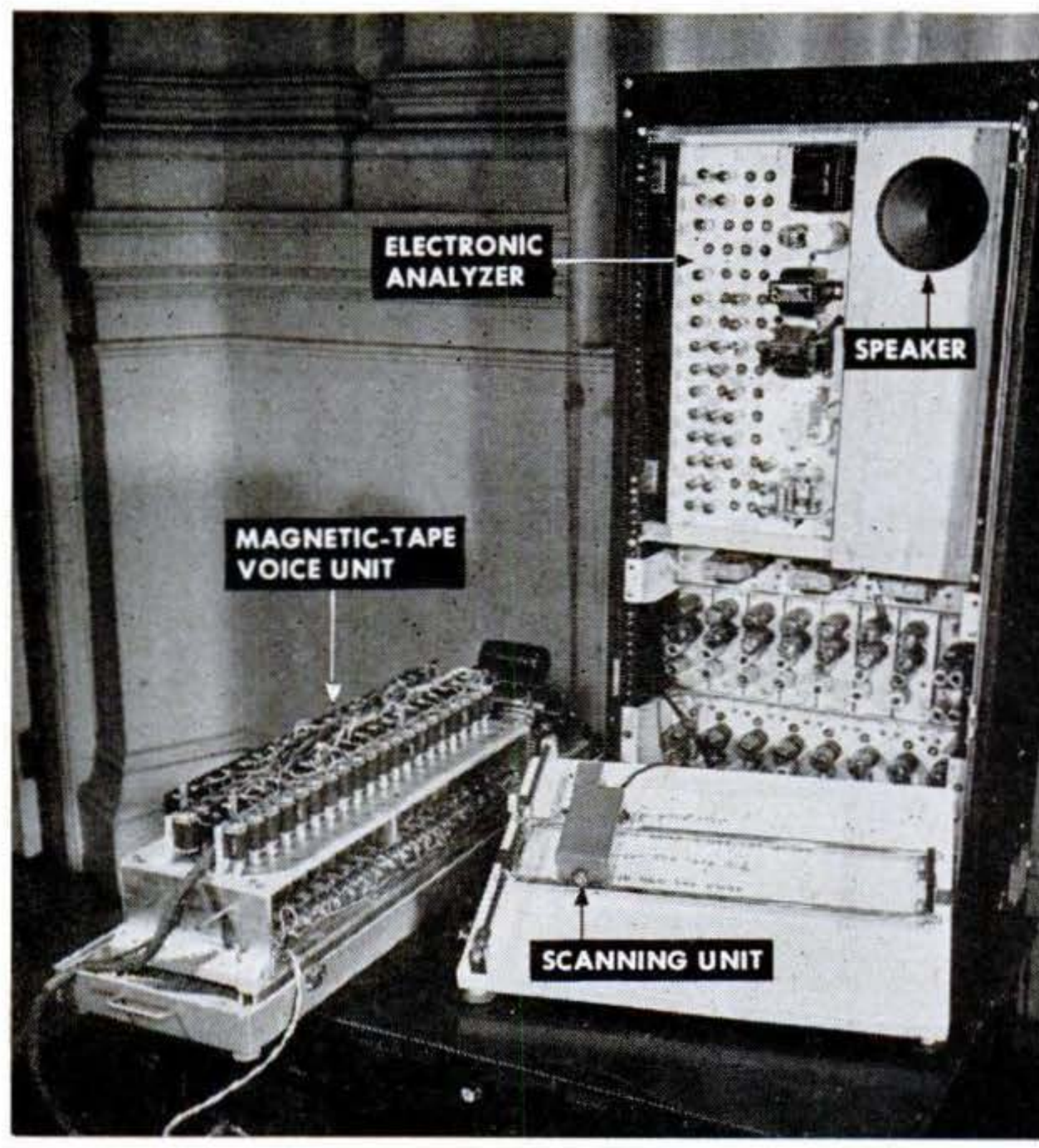
Even the existing one is an electronic-engineer's nightmare. The "simple arrangement of photoelectric cells" overflows a tall radio-equipment rack housing more than 160 vacuum tubes. Part of its brain alone uses 960 resistors. Too expensive for home use, it might be installed in libraries and institutions. It could also be hooked up as a master reading station to serve several persons using different books.

The present model was developed and built under the direction of L. E. Flory and W. S. Pike at the RCA Laboratories.

Their reading machine has three main



Closeup of voice unit shows solenoids above wheels rimmed with magnetic-tape recordings. At signal from analyzer, solenoid lets a wheel make one revolution to say a letter or word.



The whole machine: Panel behind scanning unit holds electronic analyzer and loudspeaker. At left is battery of 40 phonographs—one for each letter and word in machine's vocabulary.

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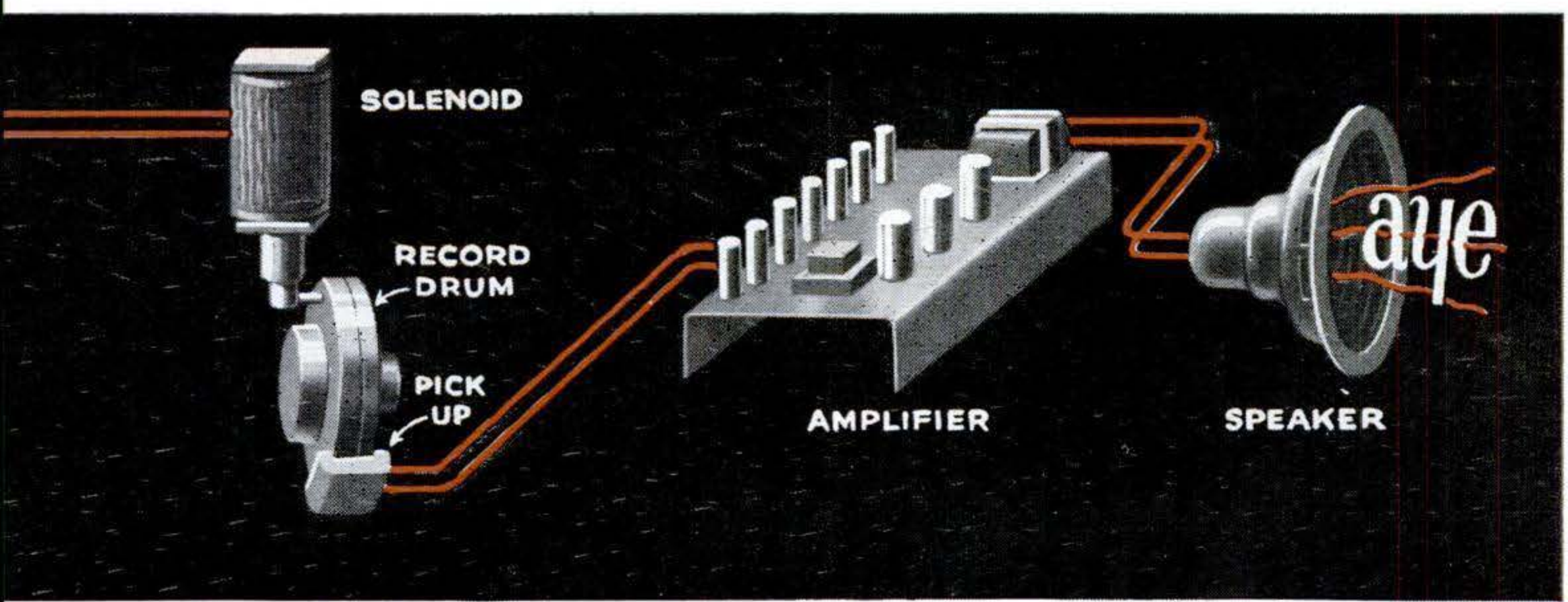


Analyzer identifies the letter and signals solenoid to play it aloud from voice recording.

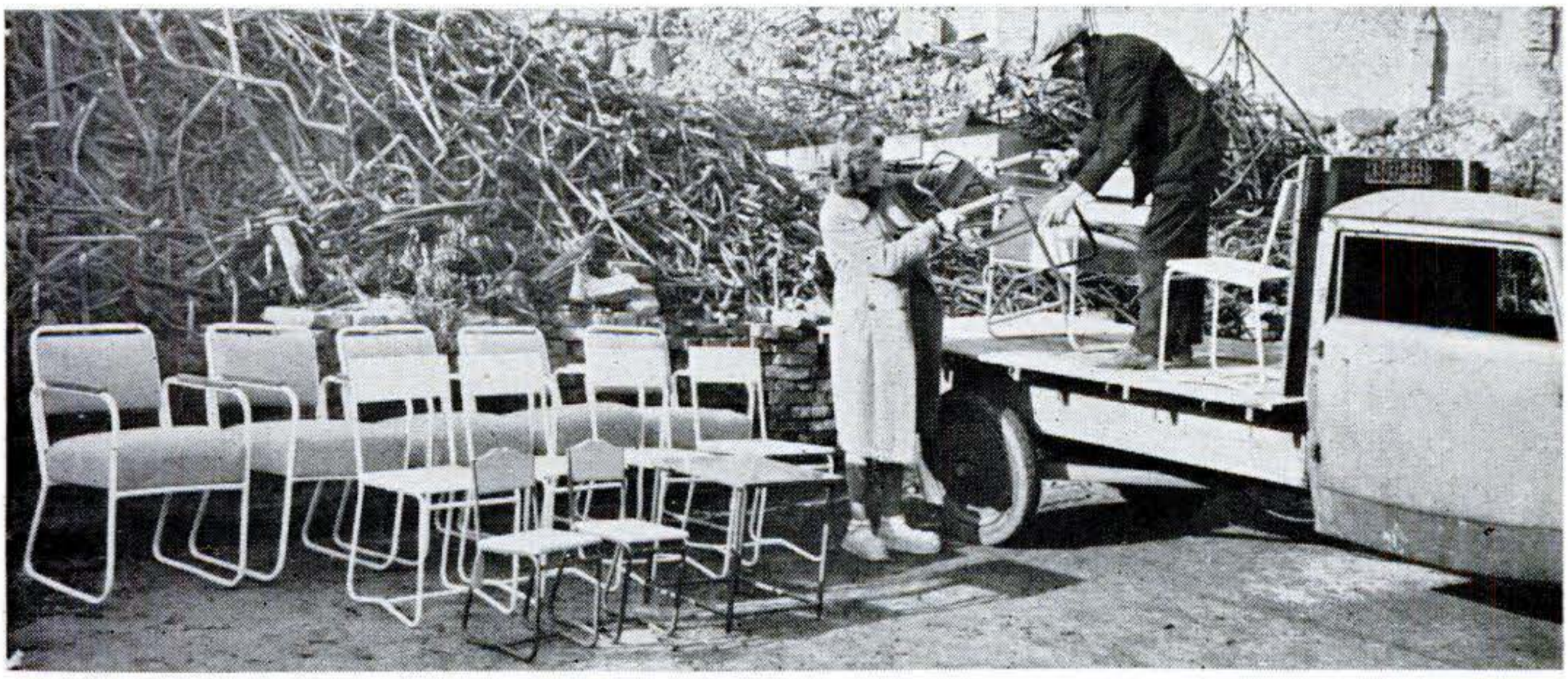
parts: an eye that looks at the printed letter, a brain that decides which of the 26 letters it is, and a voice that speaks the letter.

The eye is essentially a scanner moved across the text by hand. Inside is a special cathode-ray tube—the smallest RCA makes—with eight flying spots of light that flash on and off 600 times every second. Light from these spots is interrupted when the scanner passes over a black letter. These interruptions are noted by a photoelectric cell, which passes the signal on to the machine's brain.

The eight spots of light are strung out vertically, so that each spot picks up a different part of a letter. The top spots catch the upper parts of tall letters like "l"; the lower spots catch the ends of letters like "g"; and the middle spots are arranged to pick up details like the crossbar of an "e." In this way, each letter causes different spots to be interrupted a different number of times, creating a characteristic signal for itself.

The brain is an electronic computer similar to the machines used for complex scientific calculations. It counts the number of times each spot has been interrupted, thus identifying which letter the electric eye has seen, and tells the voice which letter to speak.

The voice is 40 magnetic-tape phonographs—one phonograph for every letter and word in the machine's vocabulary. The brain switches on the phonograph corresponding to the letter seen by the eye. The phonograph speaks that letter and then turns itself off. END



Bomb Ruins Become Furniture

A GERMAN factory made this furniture of gas pipe salvaged from bombed-out buildings in Berlin. Behind it is a heap of the raw material. Within 24 hours, those twisted pipes will be cut, bent, and welded into steel frames for more chairs and tables.

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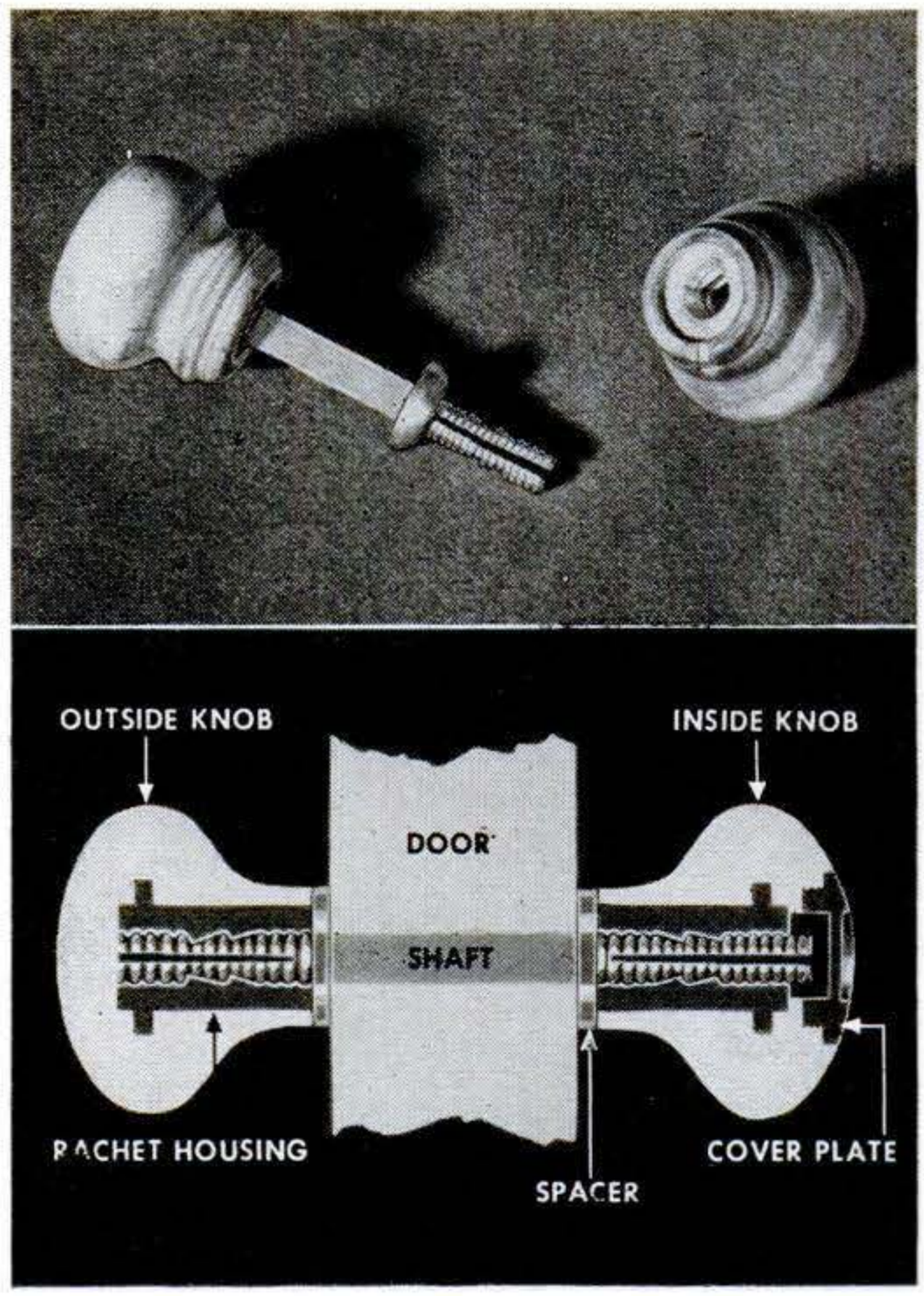
Spring Action Holds This Doorknob Fast

HAVE you ever been held a prisoner behind a door because the knob came off in your hand? That can't happen with Supernob®—the knob that once on stays on.

The device is simplicity itself, says its inventor, Edgar Gadpaille, of New Orleans, a veteran doorknob prisoner. One knob, for the outside of the door, is permanently attached to a shaft that goes through the door. The other end of the shaft has ratchet notches and is split like an old-fashioned clothespin. When the second knob is pushed on, the split shaft is squeezed together. Engaging matching notches inside the knob, the shaft springs back and is locked. A spacer screws over the shaft for adjustment to doors of different widths.

In case the lock needs repairs, this second knob has a removable plate covering a hole through which the shaft can be reached with a pair of long-nosed pliers. A squeeze and the knob slips off.



Composers Now Can Type Their Own Music

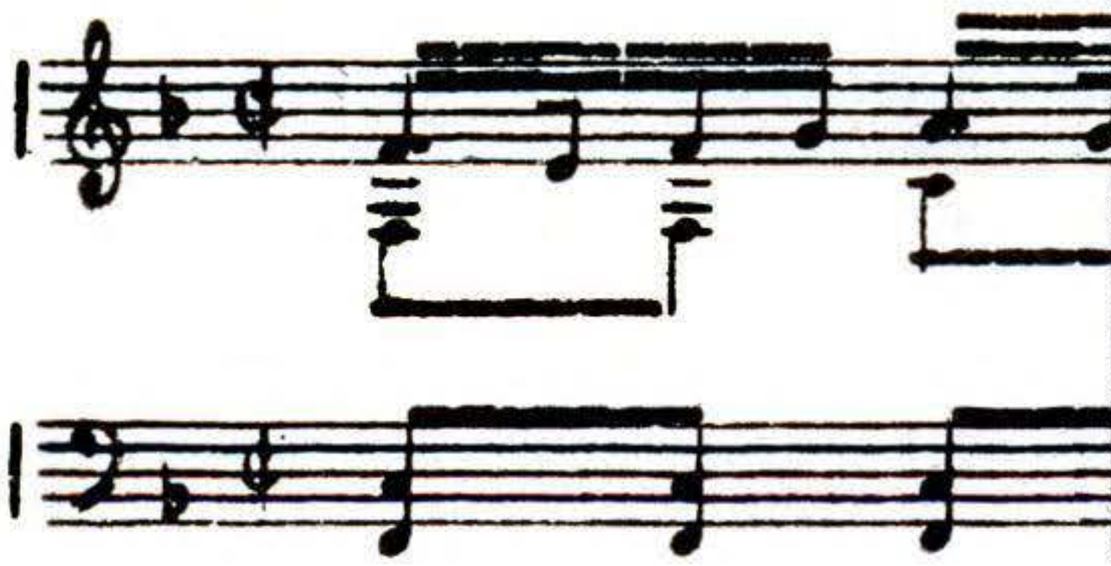
MUSIC can now be typed as easily as a business letter. The Music Writer® types standard musical notes and symbols on blank paper. A sample of its work is shown below.

The five-line staff is made first by repeatedly hitting the staff key until the width of the paper is covered, just as a single line is made on an ordinary typewriter. The carriage is then returned to the right-hand side of the machine—without spacing the paper up—and the notes and symbols added.

To do this, the note is first struck on the lower, pianolike keyboard, just as if you were playing it on the piano. This aligns the notes in the correct vertical position by shifting the whole type basket. Then the piano key is held down while the key for the proper note symbol is struck on the typewriter keyboard above.

The Music Writer covers a three-octave range without moving the paper up or down. To transpose automatically, the platen may be turned to print the notes that much above or below their normal position.

The Music Writer was invented by an Italian musician-engineer, Armando Dal Molin, now arranging for its manufacture.



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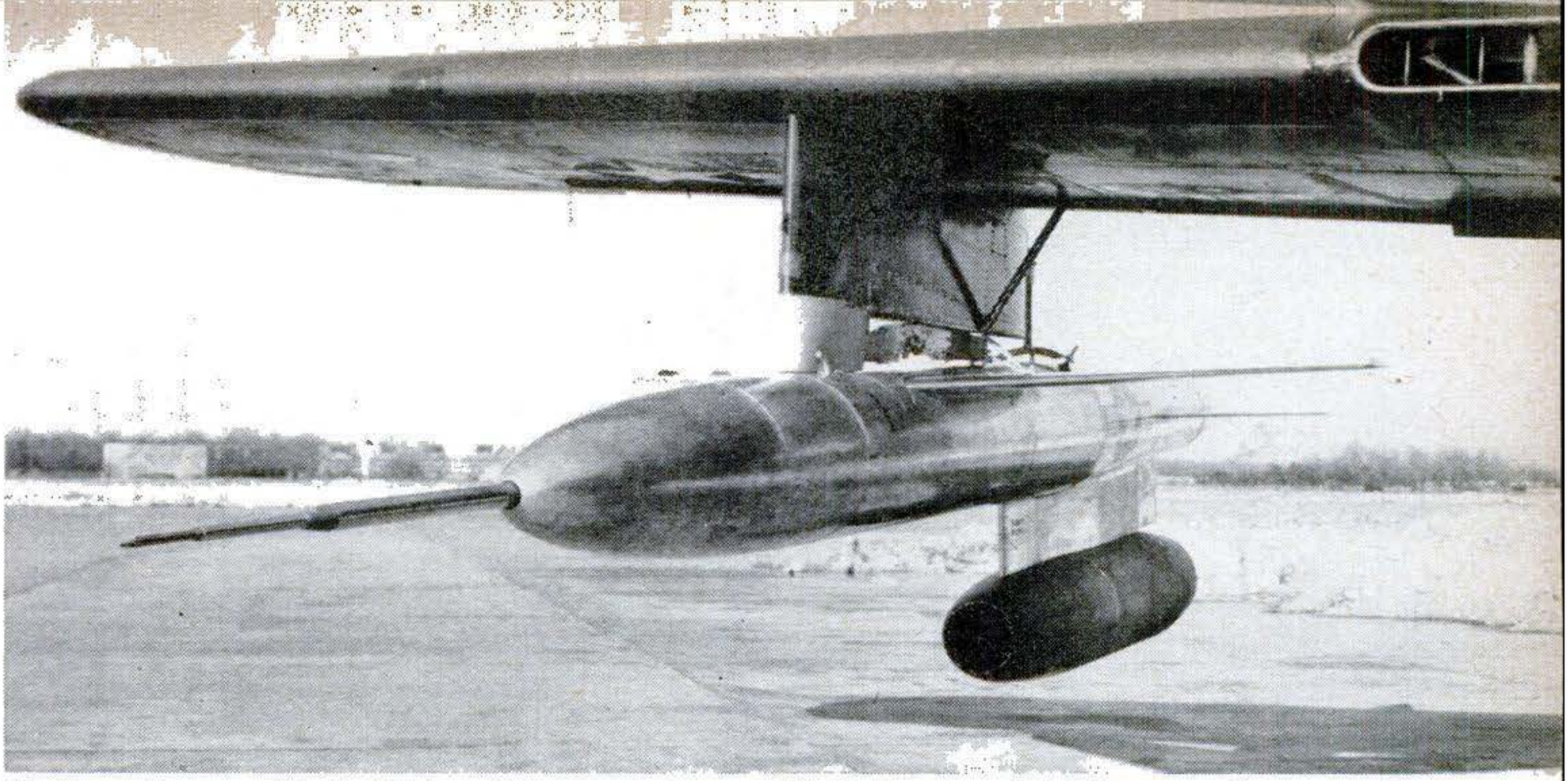


Mother plane, a Black Widow fighter, carries Gorgon IV aloft under her wing for launching, since ramjet works only when moving through air. Missile is all-metal monoplane 22 ft. long with high wing of 10-ft. span. Gross weight is 1,600 lb., of which 700 lb. is 116 gallons of 80-octane gasoline. Engine, hung below fuselage, is 7 ft. long and 20 in. in diameter.

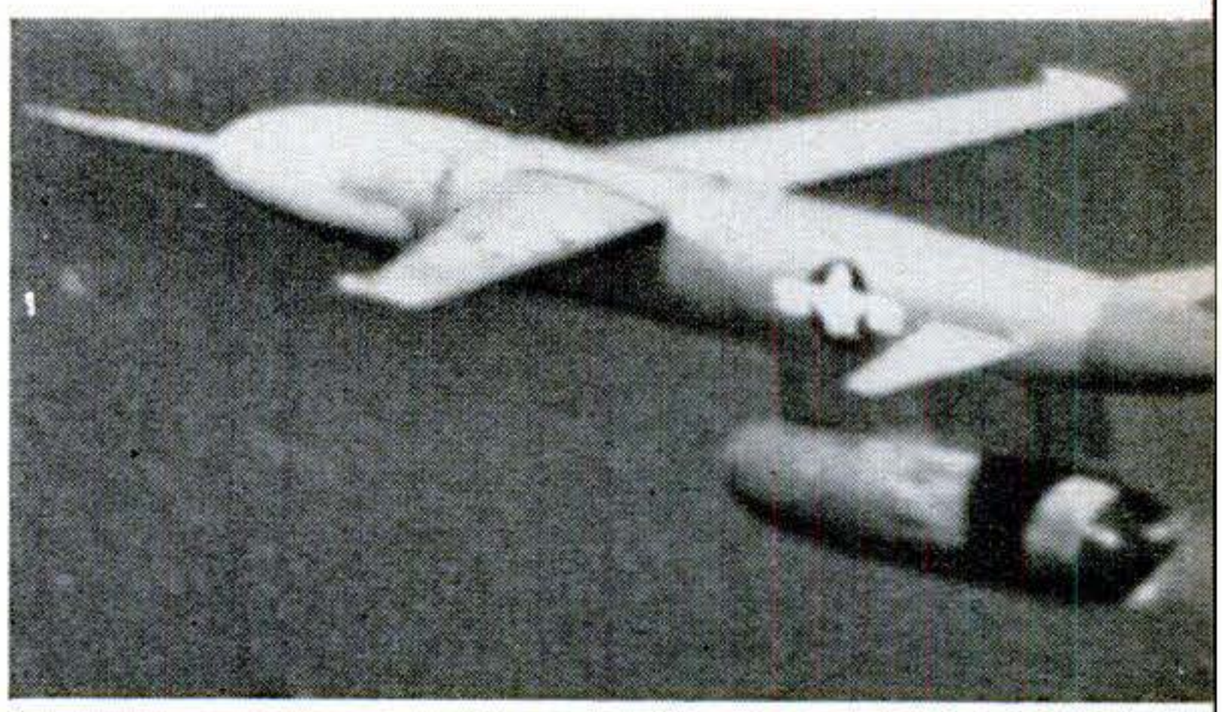
Gorgon IV Sets Record For Ramjets

A NAVY buzz bomb named Gorgon IV has lately been darting over the Pacific on stub wings in the longest flights ever made by pilotless aircraft with ramjet engines. Time: "more than 10 minutes."

This may not sound like much of a record. But ramjets, the simplest of all engines and perhaps the best for supersonic flight, are still little beyond the Kitty Hawk stage of development (PS, Jan. '49, p. 130).

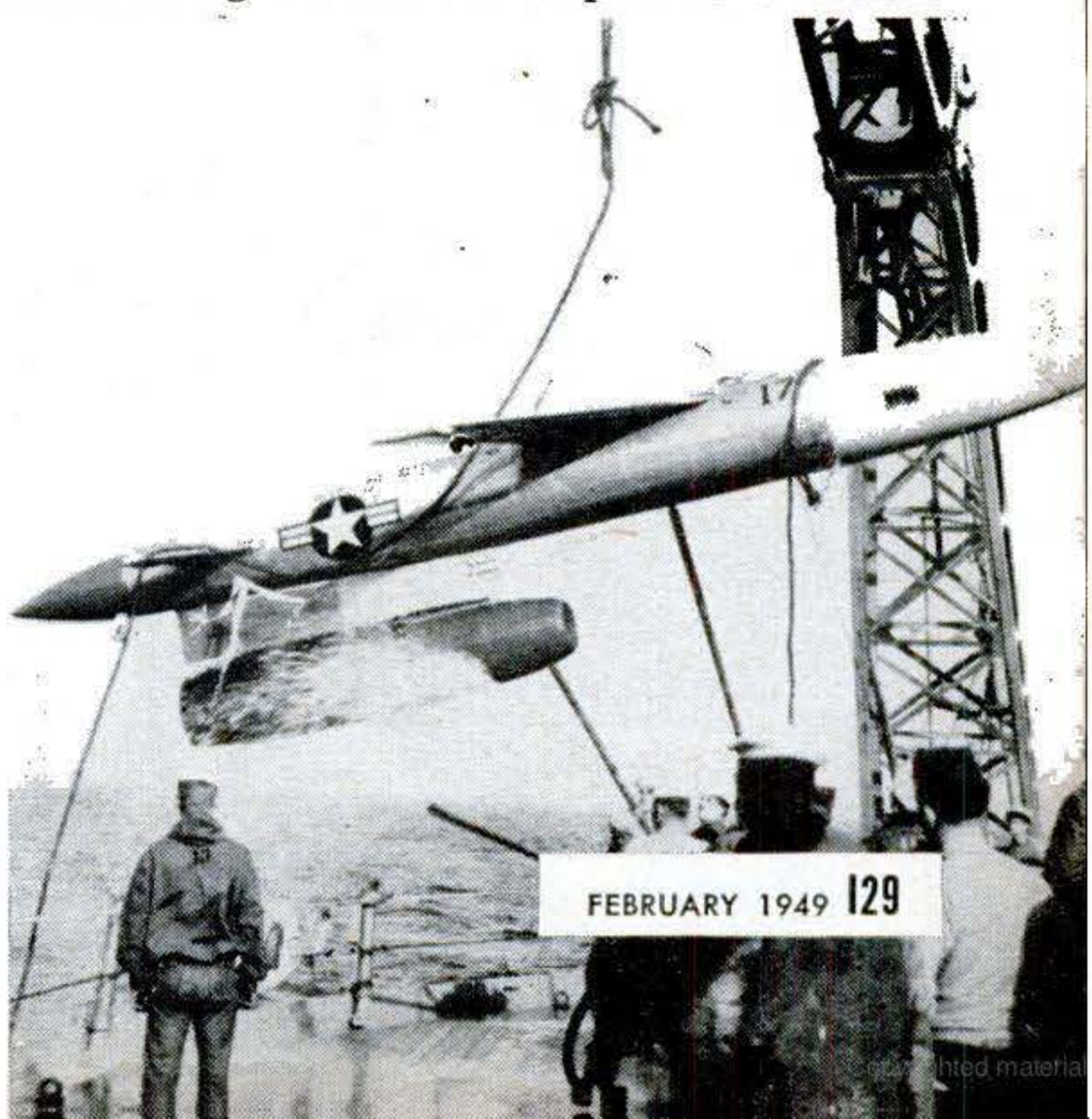
The Gorgon IVs are built for the Navy by Glenn Martin. Launched in mid-air from a mother plane, they have been deliberately held down below the speed of sound for test purposes. Several, tracked by radar until they plunked into the drink, have been fished out so little damaged that minor repairs would put them in shape to fly again.

The flights were made from the Point Mugu, Calif., Naval Air Missile Testing Center (PS, Oct. '48, p. 106) to obtain performance data on the missile's ramjet engine, developed at the University of Southern California and made by the Marquardt Aircraft Co. Except for a fuel pump, the engine has no moving parts.



In flight, Gorgon IV telemeters to a control station on the ground continuous reports of its speed, altitude, and engine performance. Its flight is guided by radio from the ground.

Missile is recovered from sea by Navy after landing by parachute that opens automatically when fuel runs out. Photo below shows salt water being washed off to prevent corrosion.



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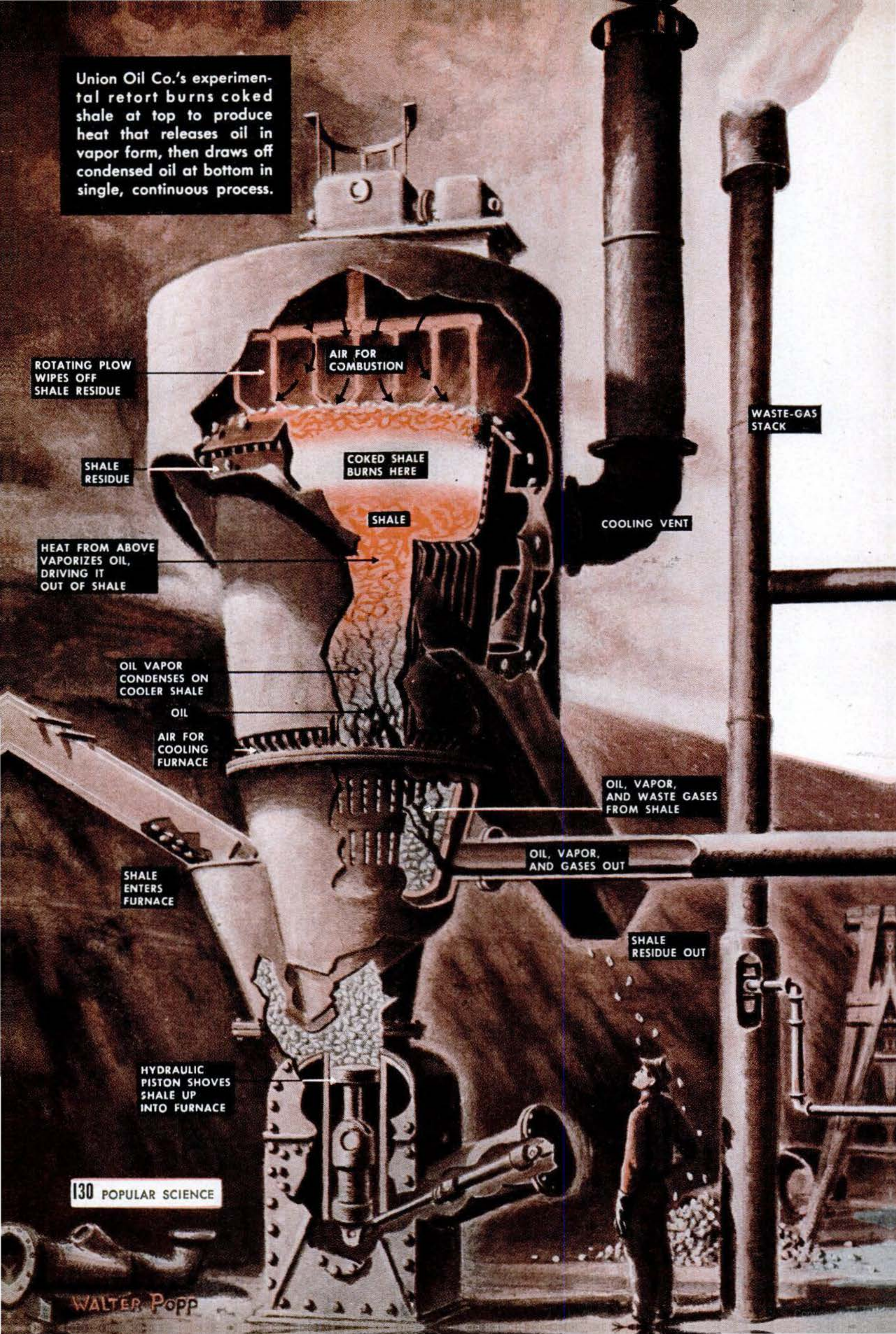
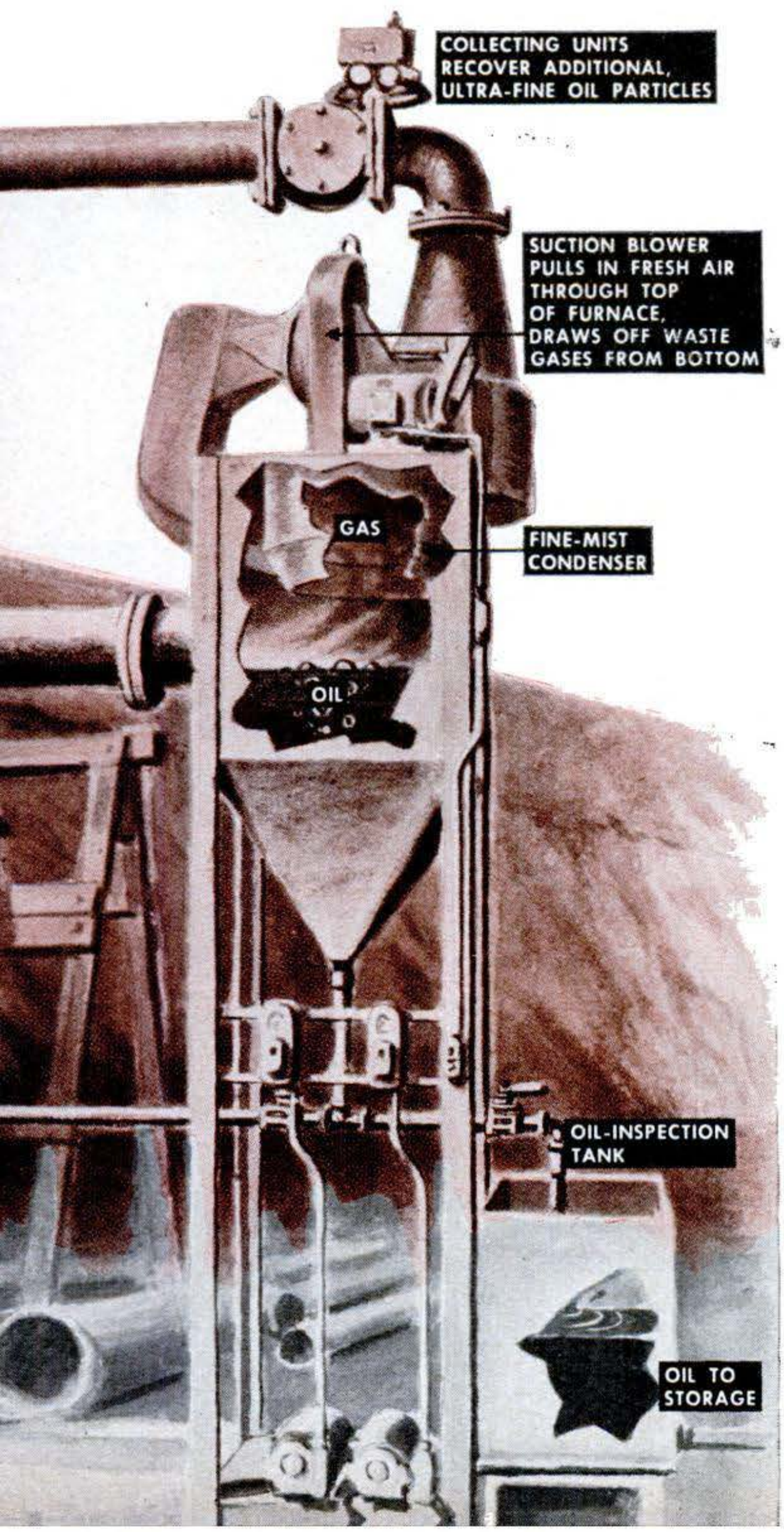


Union Oil Co.'s experimental retort burns coked shale at top to produce heat that releases oil in vapor form, then draws off condensed oil at bottom in single, continuous process.

This Oven Makes Oil Out of Rocks

Engineers are testing ways of using plant fossils from mountains to keep you well supplied with liquid fuels.



By Andrew R. Boone

YOU can't get blood out of a stone. But scientists are now taking oil out of a rock. The rock is oil shale, a kind found in nearly every part of the world. It looks like dull-grey slate, but contains kerogen, the solid remains of tiny plants that lived millions of years ago in the bottoms of prehistoric lakes. Kerogen can be processed into an oil that can be "cracked," like petroleum, into gasoline, Diesel fuel, lubricating oil, and fuel oil.

Getting oil from shale is not a new idea. Many foreign countries lacking petroleum have been doing it for years—France started in 1838, more than a century ago. The United States, however, has until recently lagged in this field, despite our extensive deposits of high-grade oil shale. We had huge petroleum supplies—and petroleum is still the best source of gasoline.

Today, however, American petroleum no longer seems inexhaustible. To be sure, we think huge reserves exist untapped, but the proved reserves—those we are sure of—contain only enough to last 11 more years at the present rate of consumption. So even though there's plenty of oil overseas, the oil industry and government agencies are searching for ways to make economical gasoline from coal, natural gas, tar sands, and oil shale. Standard Oil researchers estimate that gasoline made from shale could be sold for only four or five cents more than the present price of petroleum gasoline, although other experts put the cost higher.

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Cutting this price differential is the problem now being tackled by several oil companies and the U. S. Bureau of Mines. Engineers of the Union Oil Co., of California, have developed a new kind of furnace (see drawing on previous pages) to boil the oil out of shale kerogen. It is the first such device to operate without water—and water is expensive, or even non-existent, in the rich shale fields in the Rocky Mountain area. An experimental retort of this new type is already operating at Wilmington, Calif. It can handle in one day 50 tons of shale in chunks up to three inches long, turning out 1,500 gallons of oil.

The retort is first filled with shale. A small pile of dry kindling is laid on top and ignited. When the top layer of shale has burned to a cinder, a blower starts sucking air downward through the bed from the top to the bottom. At intervals of 15 seconds, as carbon in the shale burns the upper crust to coke, a hydraulic piston pushes up a new batch of shale from the bottom. This raises the entire load of shale. A rotating plow wipes off the shale residue into a chute.

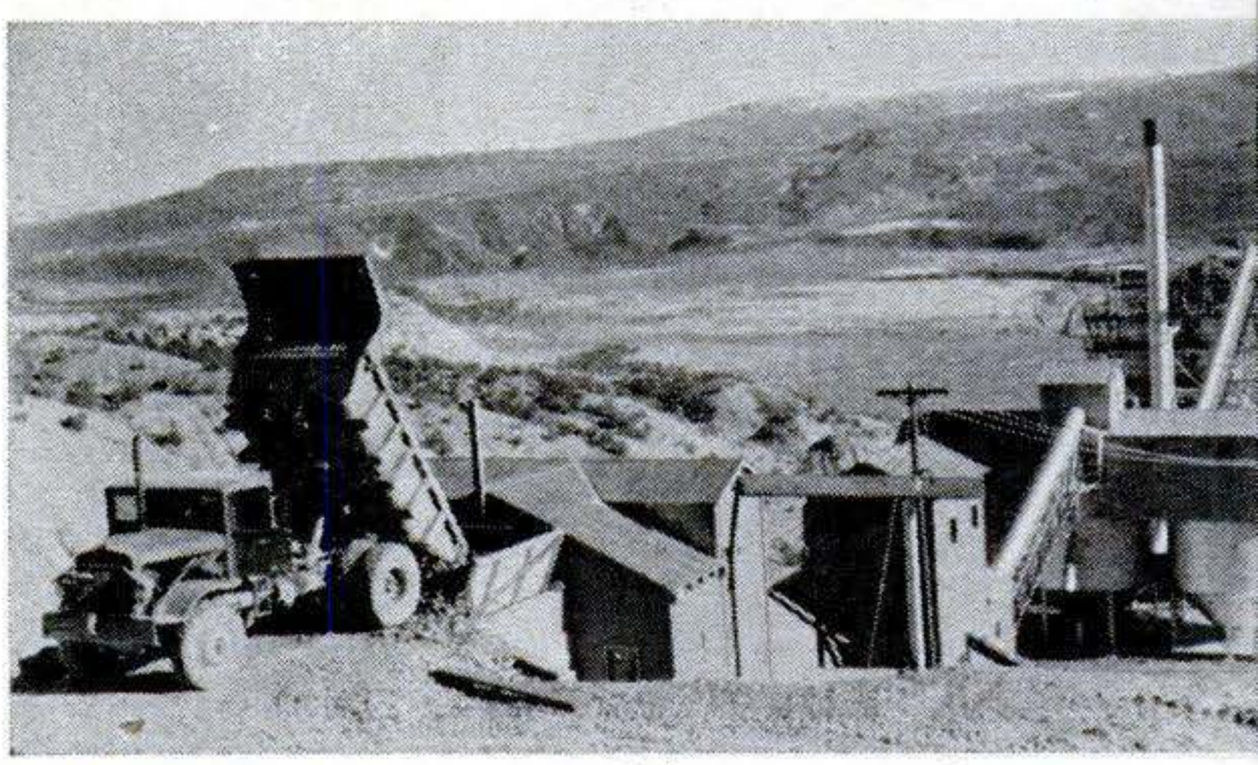
Heat Releases Oil As Vapor

Burning occurs in a zone only a few inches thick immediately below the residue. Downward-moving air helps transfer heat from this belt into the shale. All shale raised to a temperature of 750-1,100 degrees F. releases its oil in the form of vapors. Driven down into cooler shale by the air blast, these oil vapors condense. Thus the burning shale furnishes heat to break down the kerogen of the layers of shale immediately below it, while the incoming shale furnishes cold surfaces to condense the released oil.

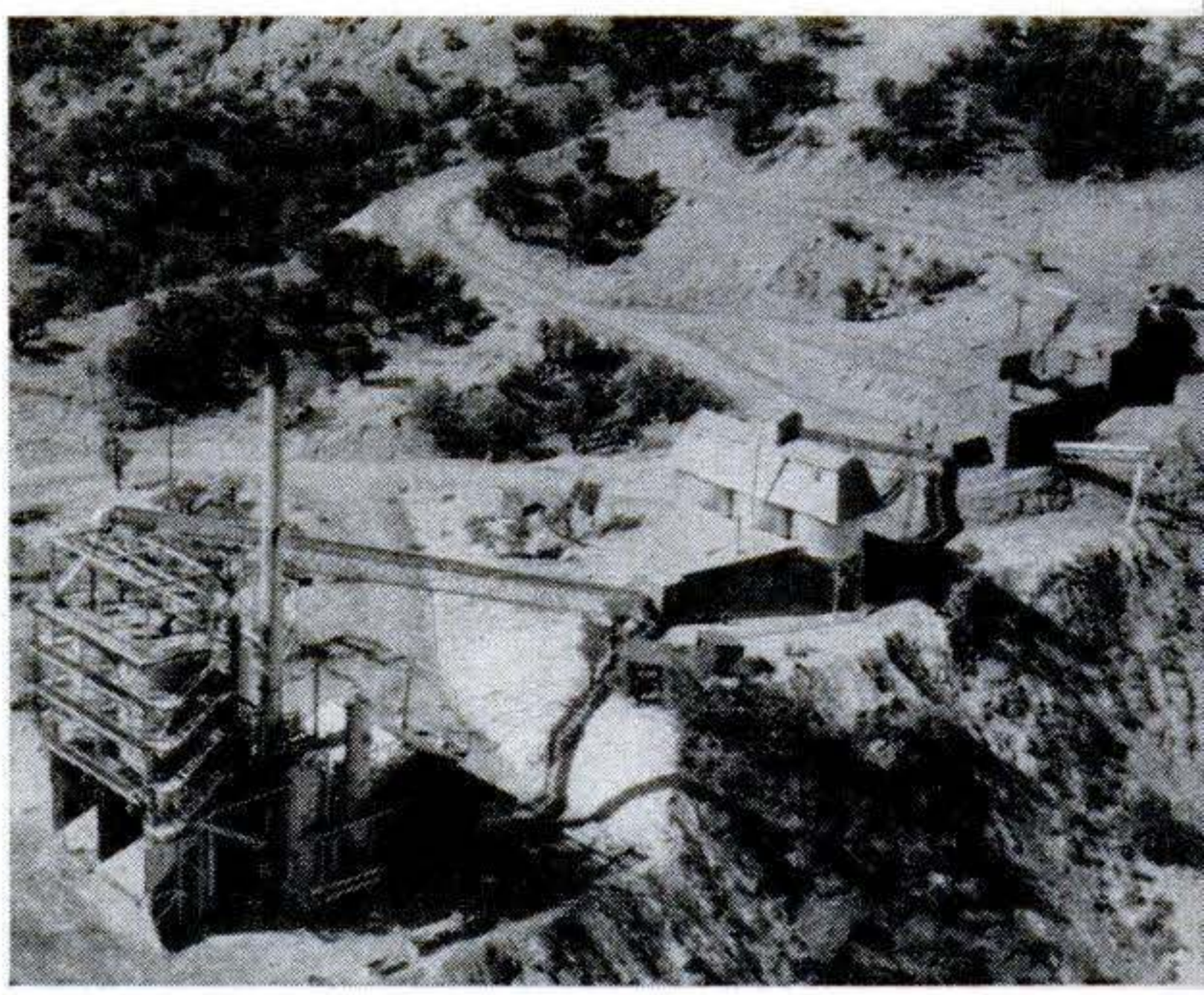
The condensed oil, together with noncondensable gases, escapes through slots into the collecting system. Two collecting units, including a "silent-sound" device that turns fine mist into large drops, recover ultra-small oil particles from the waste gas and return them to a storage tank. In a commercial plant, even the waste gas might be used as fuel for steam electric generating plants. Union Oil engineers estimate that waste gas from 35 full-size retorts could produce as much electricity as Boulder Dam.

Still another method of getting oil from shale is being tried by the Standard Oil Development Co. at the Esso Laboratories in Baton Rouge, La. There shale will be pulverized to the consistency of fine sand before being heated to extract the oil. The finely

In sharp contrast to most underground mining, huge machines are used in shale quarries. This is because shale is strong, permitting excavation of large, high rooms without supporting pillars.



Conversion of rock into oil begins as a dump truck empties shale into a hopper that feeds it to the first of a series of crushers. Photos here show Bureau of Mines' Colorado plant.



Crushed and screened, shale is fed from storage bins on belts over scales that continuously weigh all material. Then it goes into the top of the retort (far left) for processing into oil.

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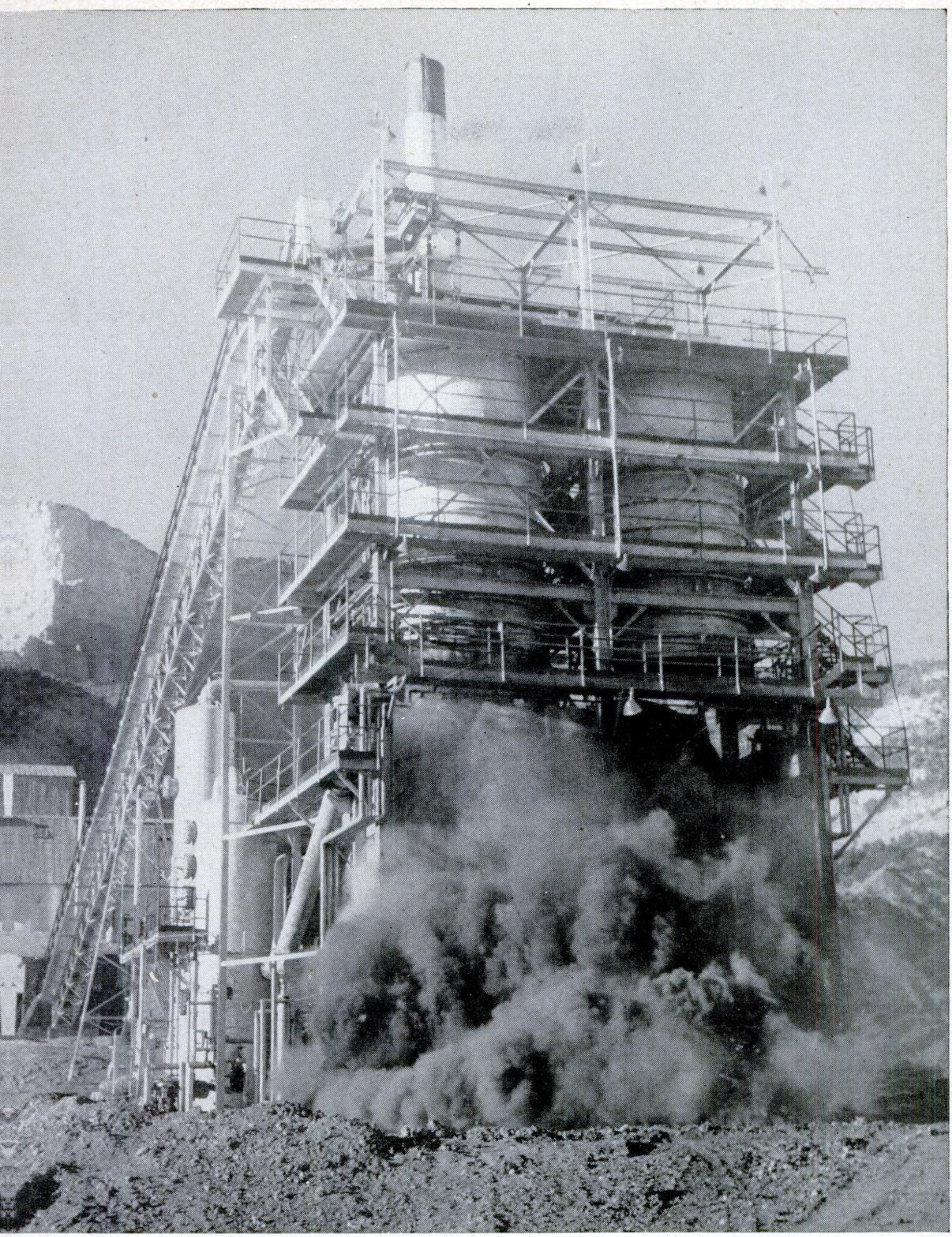

Smoke and fire mark the end of a shale-processing run at the Bureau of Mines' retort. Unlike Union Oil Co.'s continuously fed retort, this furnace burns one charge of shale at a time, starting at top and working down to bottom. At end, retort's bottom opens like trap door, dumping fiery residue onto ground. In principle, however, the furnaces are same.

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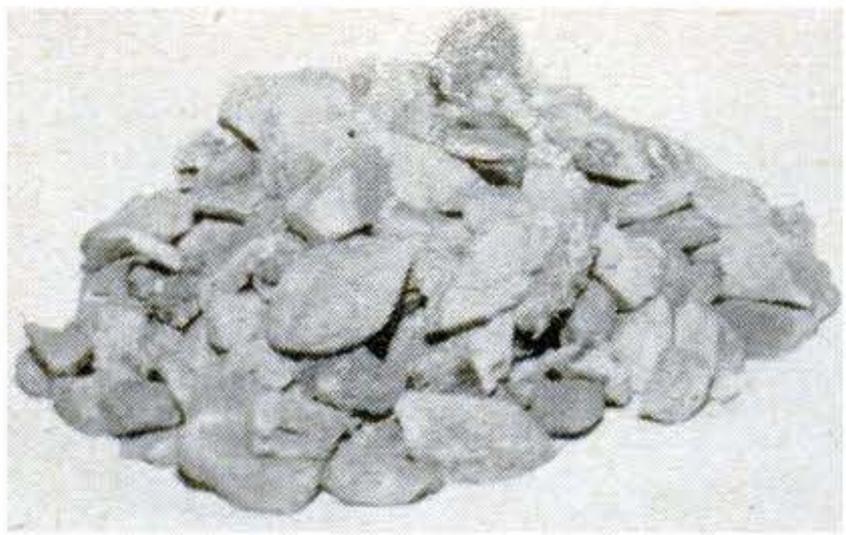

How much oil can you squeeze out of rock? Beakerful above was obtained by heating small pile of shale (left) to 750° F. Remaining is pile of cinders (right), for which no definite use has been found. Oil shown is crude, must be refined to make gasoline and other products.

ground shale behaves like a liquid when steam or gas is blown up through it and can easily be pumped through pipes from one reaction vessel to another. This "fluidized-solids technique" eliminates many of the problems involved in handling raw shale.

The oil obtained from shale by any of these methods is a crude, thick liquid that must be refined to make gasoline and other things. So far, no economical method of refining shale oil into usable products has been found. The naphtha in shale oil contains tar acids and tar bases not usually present in crude petroleum. Straight-run shale gasoline is a small fraction, having an octane rating below 60, and is high in sulphur, gum-forming, and unstable in color. Aviation gasoline and jet fuels probably can be made, say the experts, but at high cost. "Admittedly," says Boyd Guthrie, chief of the Bureau of Mines project at Rifle, Colo., "the refining of shale oil into usable products presents unusual challenges."

Transportation a Problem, Too

Whether the crude oil will be refined at the shale mines or nearer big cities is a question over which the economists are still arguing. The oil solidifies at room temperature, so it must be kept warm during movement through a pipeline. A 100,000-barrel refinery, plus a pipeline for oil or gasoline from the Colorado deposits to Southern California, would cost an estimated $200,000,000.

The retorts that cook the crude oil out of the shale will probably be near the mines, however, since it seems pointless to transport the heavy rock—of little value after processing—any farther than necessary. The first production center is likely to be in the Colorado-Utah-Wyoming area, which has some of the country's richest oil-shale deposits. Some beds in that mountainous region are 1,300 or more feet deep, and one 70-foot vein, called the Mahogany Ledge, yields about 50 gallons of oil for each ton of shale.

Two experimental shale mines are already being operated by the Bureau of Mines near Rifle, in western Colorado. One, a "selective" mine, digs out different kinds of shale so that the retorts get a thorough test. The other works only one vein—the Mahogany Ledge—as a commercial mine would. Various tools and mining methods are being tried.

Since shale is hard and strong—unlike coal—big underground rooms can safely be cut from it, permitting low-cost, mechanized mining. The selective mine has a test room, unsupported by pillars or timbers, 70 by 100 feet in area. The commercial demonstration quarry is about 50 feet high and 60 feet wide (it has supporting pillars), large enough for the machines used in road construction and strip mining. One drill, operated by two men, makes enough holes for 1,000 tons of rock per shift. A three-cubic-yard electric shovel and an overshot loader of similar capacity put the broken shale into big Diesel trucks.

Simultaneously with the shale-oil program, research into other sources of oil products is going on. More money is being spent on this combined problem than was expended on catalytic oil cracking a decade ago. Two huge plants are now being constructed to convert natural gas into liquid fuels. The Bureau of Mines has three plants now working or under construction. One, at Louisiana, Mo., produces 200 barrels of gasoline daily from coal. At Morgantown, W. Va., methods for making carbon monoxide and hydrogen from coal are being developed. And at Laramie, Wyo., the Bureau is conducting its own research on shale-oil refining. Science is fighting on many fronts to end the threat of an oil famine. END

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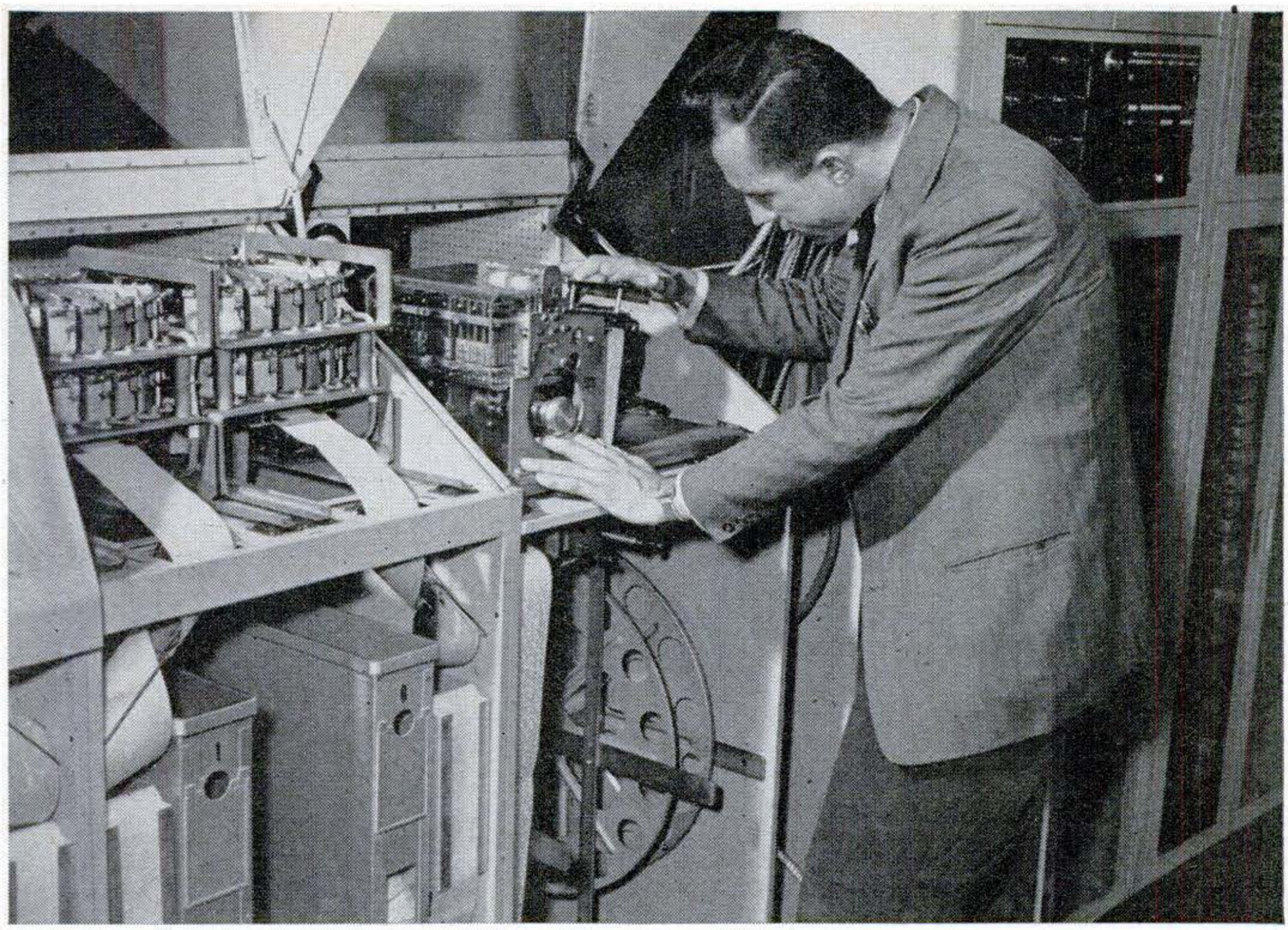

Perforated-tape records of thousands of phone calls are run into first of machines that assemble information on each call and compute its duration, then sort these figures by phone numbers, assemble all calls from each number, and print data for figuring the charges.

Your Phone Dial Computes Your Bill

This new electrical brain now makes long-distance dialing possible.

PS photos by Hubert Luckett

ONE of the biggest obstacles to making long-distance telephone calls without speaking to an operator has been overcome: a machine has been built to see that you are properly charged for such calls. It's a gigantic electrical contrivance that remembers what numbers you have called and how long you talked.

Your dial will operate it. The first such machine, called an AMA (for Automatic Message Accounting), is in use now at Philadelphia. Since it takes a long time to build and install such machines and the other equipment, it may be a long time before your phone is connected to such a device.

The AMA now at work can keep track of 100 calls at once, and even disregards local calls from phones with flat-rate service.

The system, developed at the Bell Telephone Laboratories in New York, actually consists of two machines—one in the Philadelphia suburb of Media, one downtown.

When somebody in Media dials a message-rate or toll call, AMA assigns that call a code number and then punches holes in a paper tape for the code, the calling number, and the number called. When the conversation starts and when it ends, AMA records the month, day, and exact time.

The second machine, pictured here and on the next page, later reads the tape, sorting out the record of each call from hundreds of others, and types out a report.

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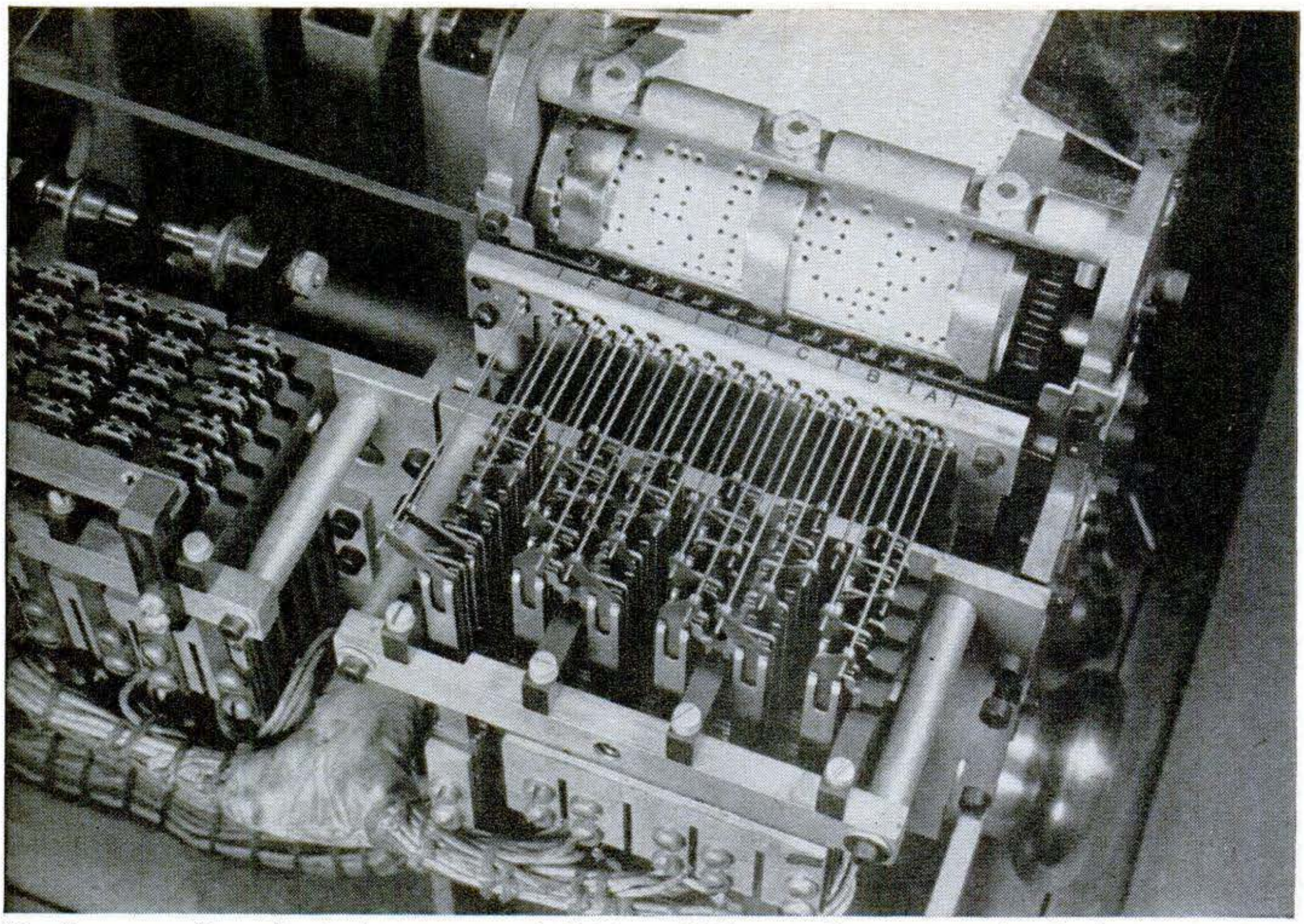
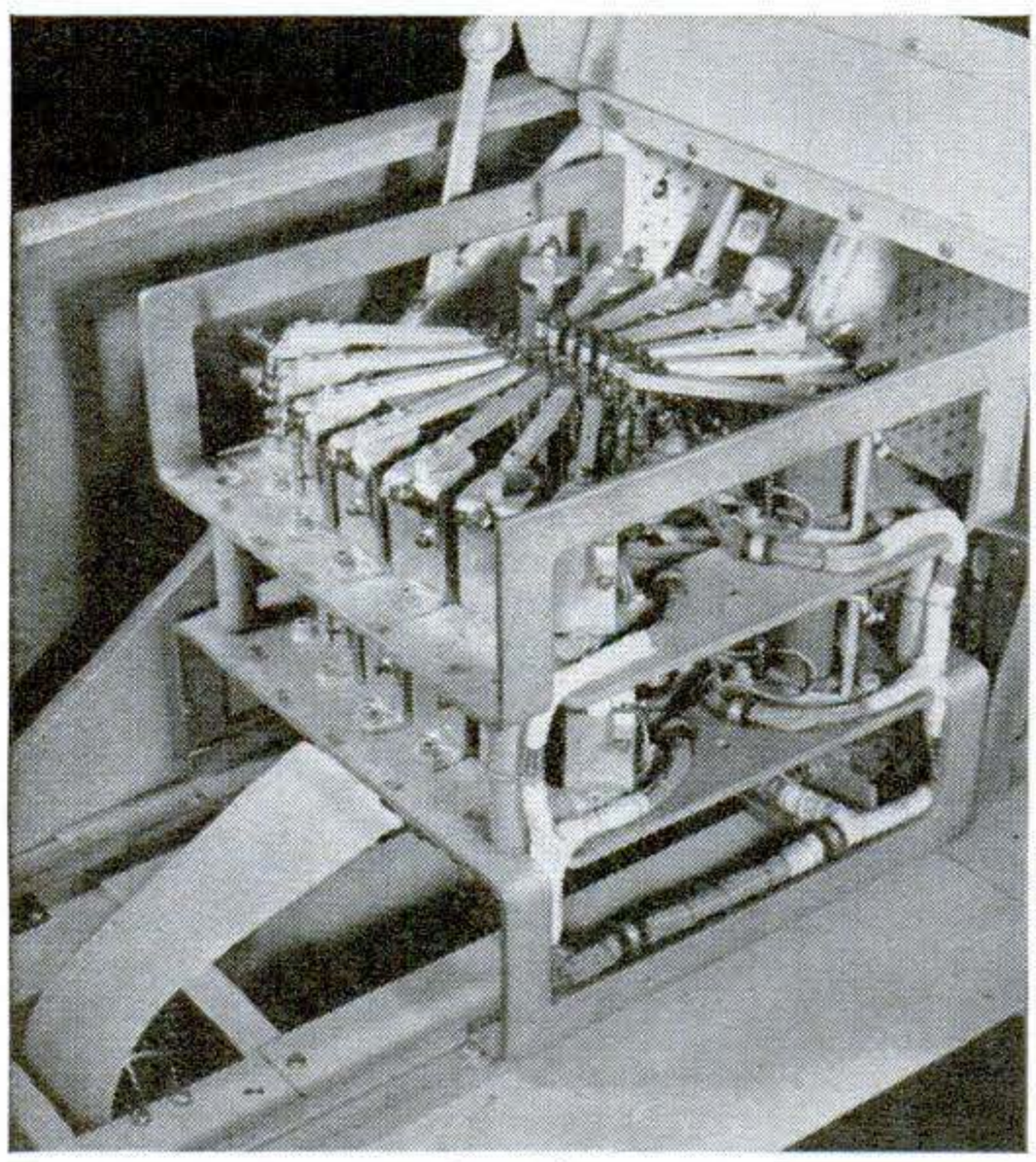
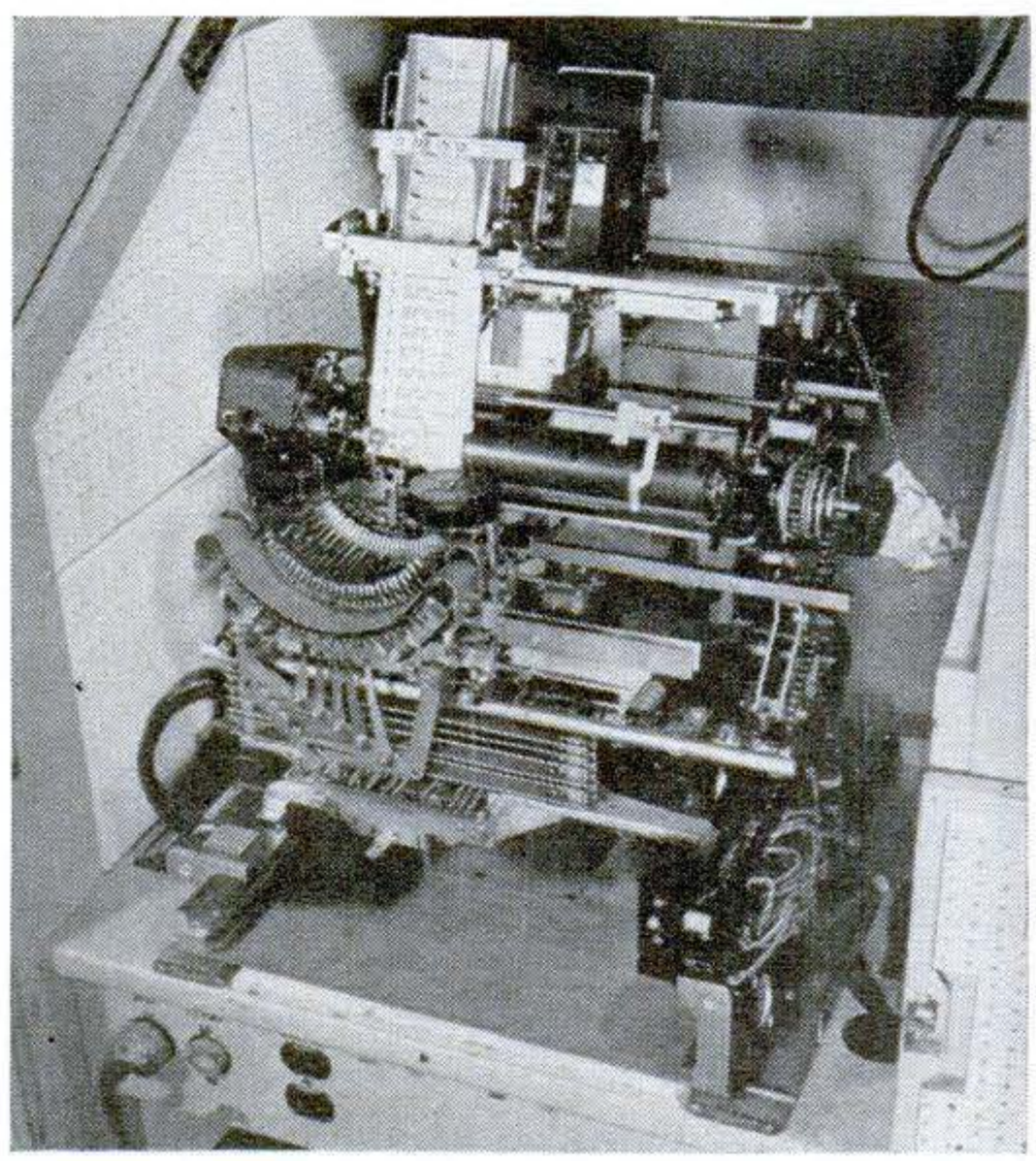


Reader, one of two basic components of AMA, feels holes in tape with long fingers. When finger finds a hole, it sends an electrical impulse to corresponding magnet in a perforator. Each AMA unit has one reader feeding a bank of perforators. These turn out new, composite tapes with call information decoded one step closer to final slip used for billing the customer.



Perforator has 28 electromagnets driving rods that punch holes duplicating pattern in original tape. Each perforator has own code, and operates only if reader sees that code, thus grouping information. Process is repeated as many as four times to complete grouping. Individual tapes are spliced into new master tapes for each step in the decoding.



Final tape operates printer that types out slip listing, by subscriber's number, the local message units he used and long-distance numbers he called and the length of those calls. These individual charge slips come off the printer in numerical order, and are used by clerks to prepare subscribers' bills. Machine doesn't figure actual tolls, since rates vary with time of day.

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Homemade Air Sled Weighs Less Than Pilot

WHILE Consolidated Vultee is building 139-ton B-36 bombers, four of its young research engineers have been spending their spare time cooking up a tiny plane that weighs only 150 pounds—less than the pilots who ride it like a belly-whopper sled.

The WeeBee was born of enthusiasm, ingenuity, and a lot of hard work. To fly this unique aircraft, the pilot stretches out, face down, on top of the fuselage. His hands extend through a pair of ports into the fuselage to grasp abbreviated controls. With his toes he waggles the rudder.

The four pioneers of the peewee WeeBee, Bill Chana, Ken Coward, Karl Montijo, and Jim Wilder, claim that there's nothing to building the world's lightest man-carrying airplane. You tour the war-surplus stores. You find an unused Menasco target-drone engine, and plunk down $10 for same. You purchase a few tools for $60.80. You pick

One man easily tilts the WeeBee, so named because its twin-cylinder, two-cycle 18½-hp. target-drone engine sounds like a bee buzzing. Plane is 15 ft. long and has 15-ft. wing span.

The WeeBee in flight. Following completion of ground tests, main wheels were moved back and a nose wheel was added to provide the fixed tricycle landing gear shown in this photo. The main wheels were once the tail wheels of AT-6 trainers. The plane lands at 45 miles an hour.

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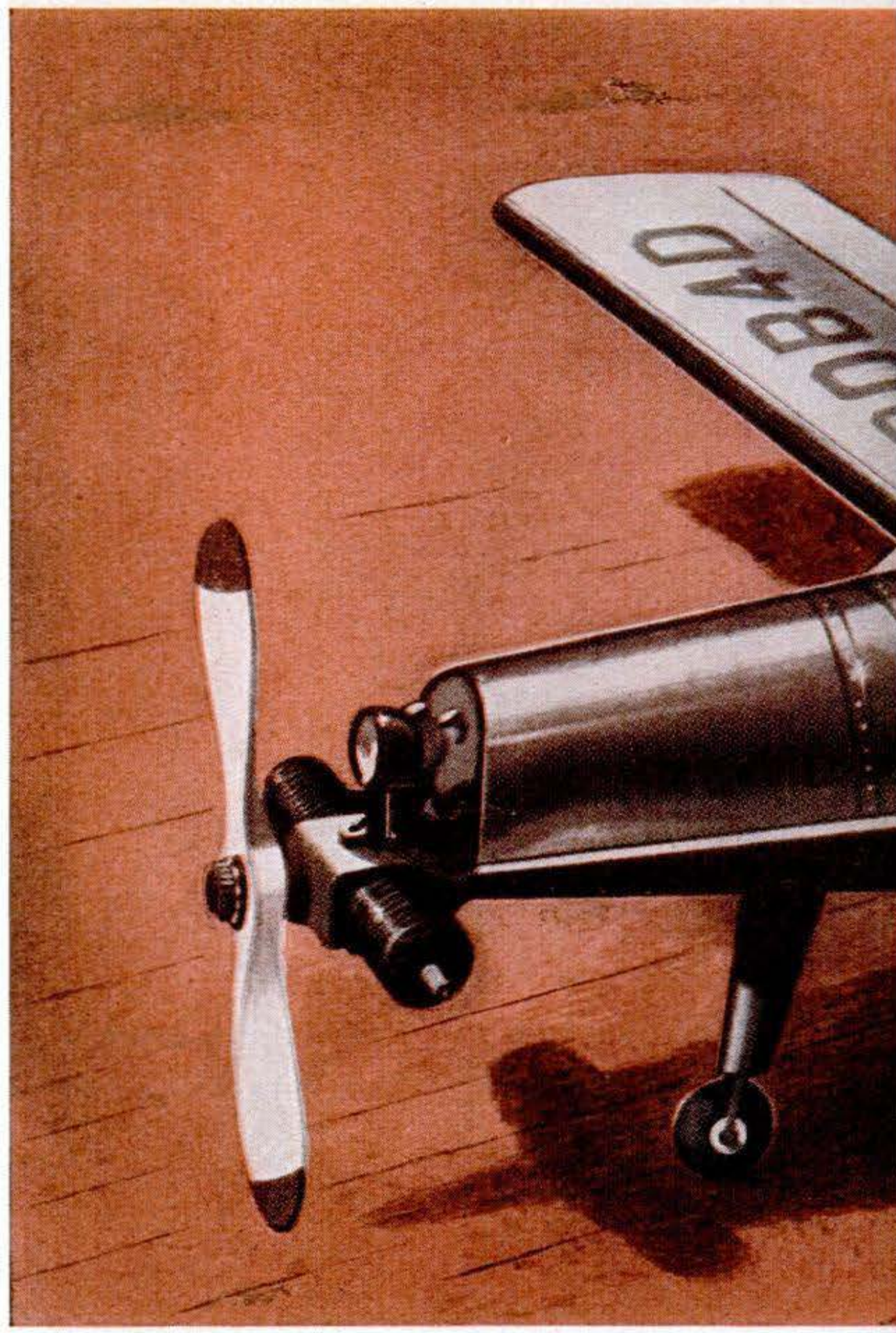
up odds and ends of materials for $49.90, pay out $24.15 for parts, locate a propeller for $50, spend $81.85 here and there for miscellaneous items. And you discover, after some 700 man hours of labor and the outlay of $276.70, that you've got an airplane.

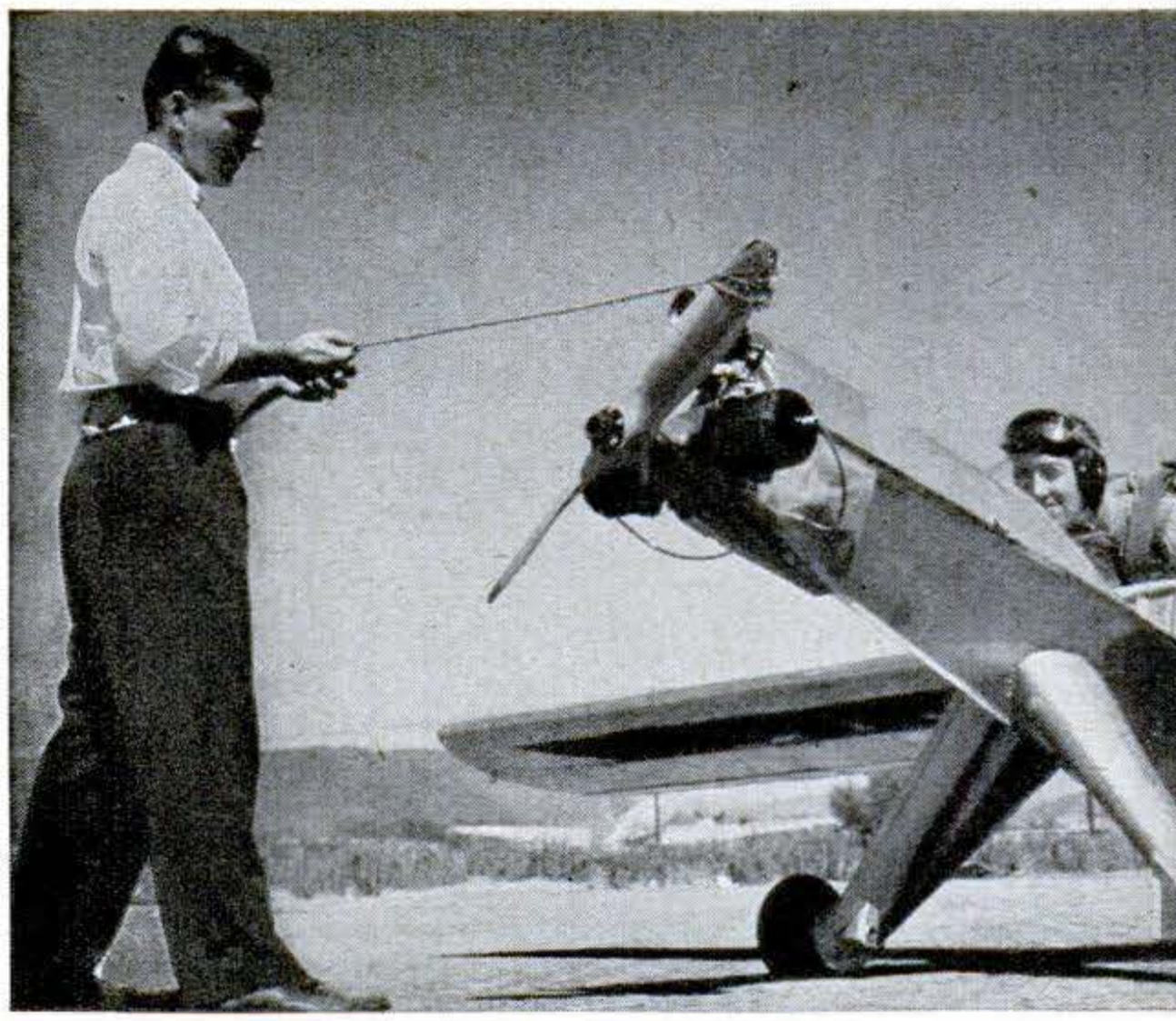
Although it may look like a toy, so much strength has been built into the WeeBee that the designers say it can be stunted. Other claims of its fond fathers are that it will fly two hours on five gallons of gas; and that, wide open, it will nudge 90 m.p.h. Who knows, they ask, what a grown-bumble-bee version might do with rockets under its wings?

One of the designers, Ken Coward, is strapped atop fuselage to prevent slipping or bouncing off. A single tug at a parachute release frees him to bail out—or off—in case of trouble.



Cutaway drawing shows how the prone pilot

His chin resting on a small pad of foam rubber, the pilot gazes at three instruments: airspeed indicator, altimeter, and tachometer. His only protection in flight is the small windshield.



Prop is pulled around by William Chana to start the engine. The short rope is attached to a nylon hood that fits over the blade tip. It slips off when the propeller begins to spin.

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FLAP HANDLE

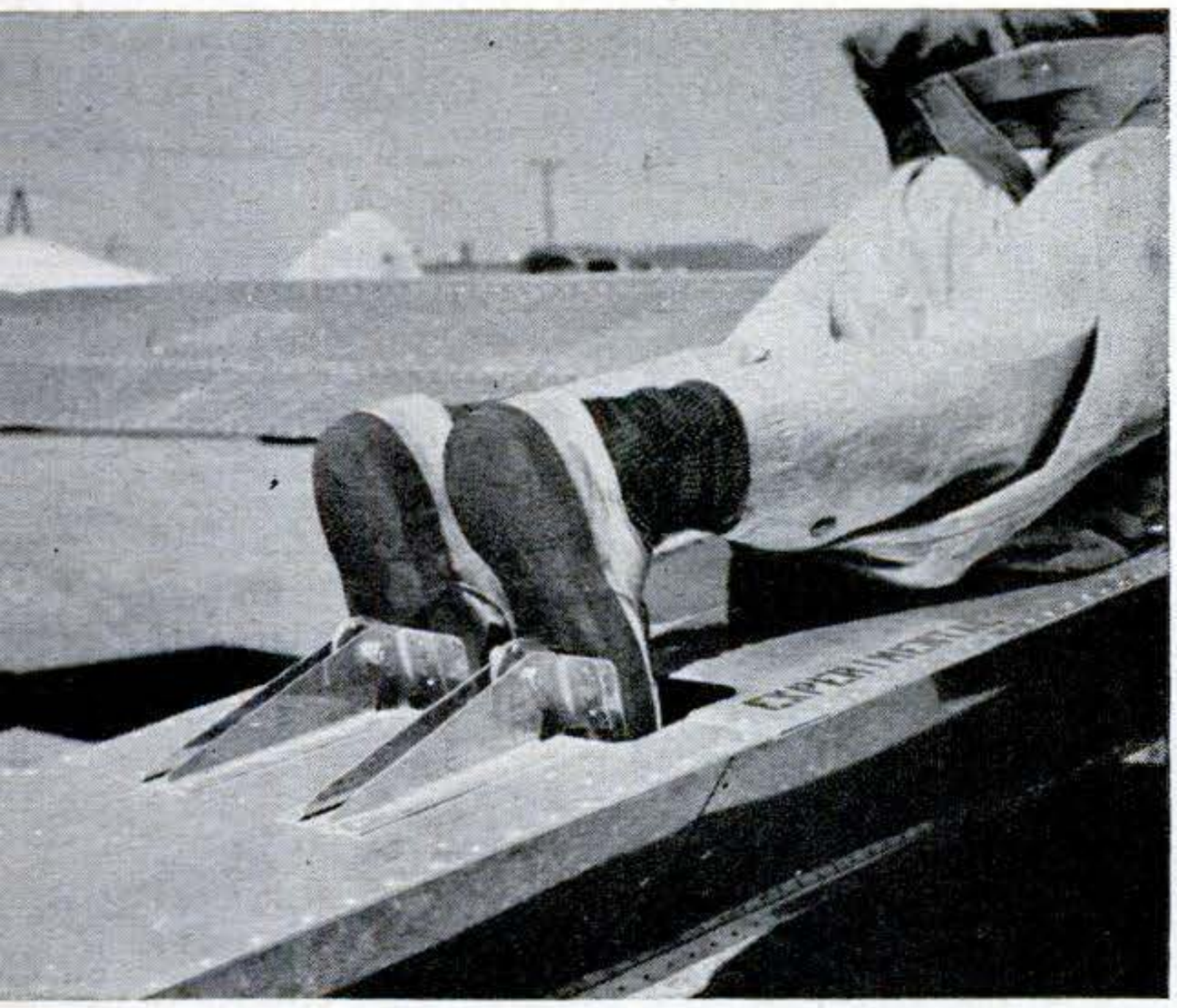
RUDDER PEDALS

THROTTLE

CONTROL STICK

FAGANS

is able to operate stick, throttle, and flap controls through ports in the top of the fuselage.



With his feet resting against two metal plates, the pilot operates the rudder by pressing his toes against hinged pedals. Stick and pedal co-ordination is same as in many small planes.

The tail group is unusually large, to provide better control at low speeds. The tail skid shown here has been replaced by a steerable wheel. External riveting simplifies the construction.

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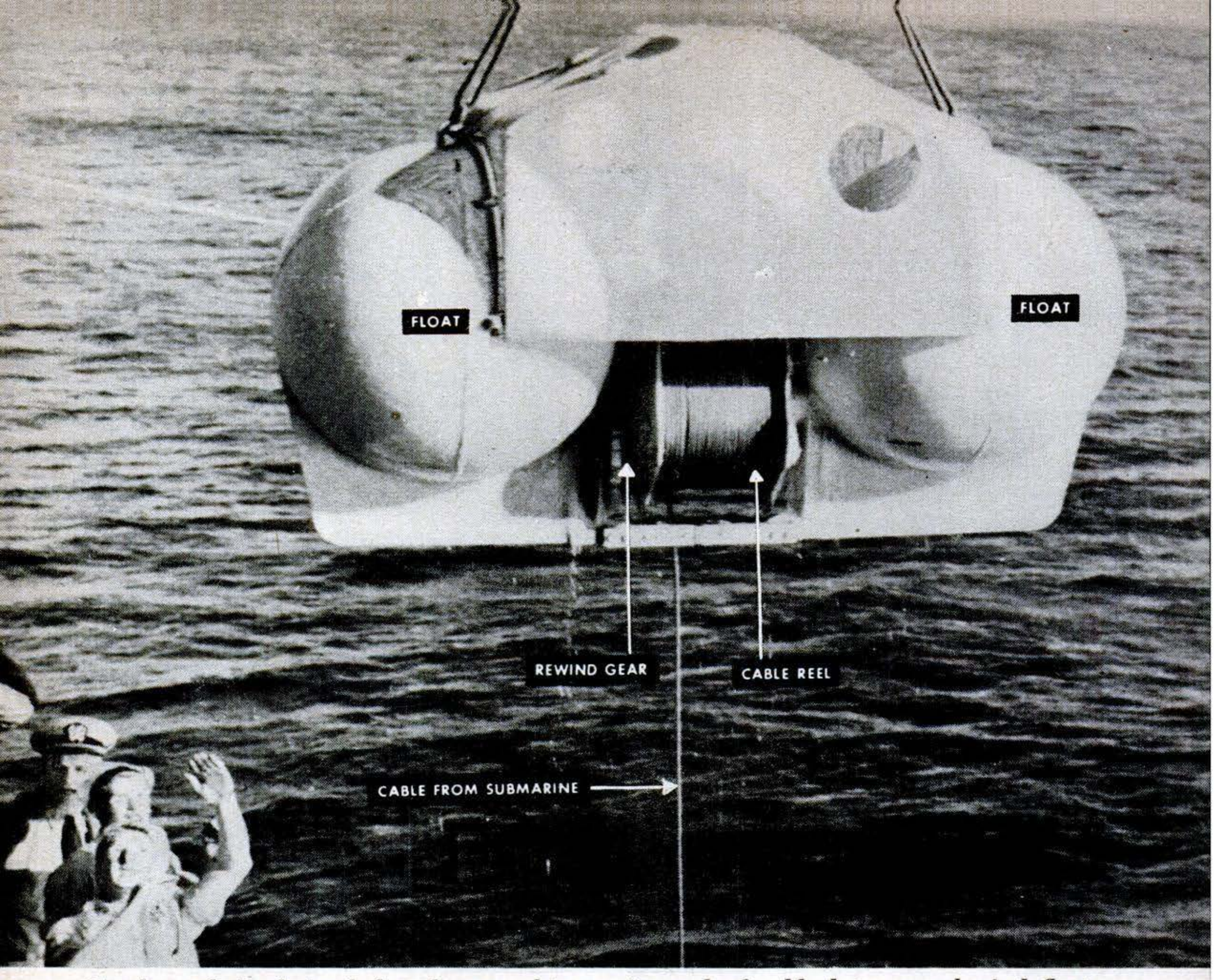

New buoy, being hoisted aboard rescue ship, carries reel of cable between spherical floats.

Life Line Bobs Up From Trapped Sub

SUBMARINES of the U. S. Navy will soon carry their own life lines—thus boosting their crews' chances of escape if trapped alive on the ocean bottom.

A new messenger buoy, released from a sub, unreels a heavy cable as it floats to the surface. The cable then serves as a line to haul down a rescue chamber. Each submarine will carry two of the buoys, one in the bow and one in the stern, in case either end of the sub is damaged.

The Navy expects the new device to speed rescue work tremendously, since it eliminates the need for divers, who formerly had to go down and attach the cable. Old-type marker buoys carried only a telephone line from the disabled sub.

The buoy also permits rescues at greater depths than the 500-ft. maximum that divers can reach. Service tests of the new system off Portsmouth, N. H., were made at 300 ft., but Rear Admiral C. B. Momsen, famous pioneer in submarine rescue research, expects it to work at any depth to which a sub can sink without crushing.

Each buoy is shaped like a dumbell, with a reel of cable mounted between two spherical floats. An arrangement of cams and pawls locks the reel when the buoy reaches the surface.

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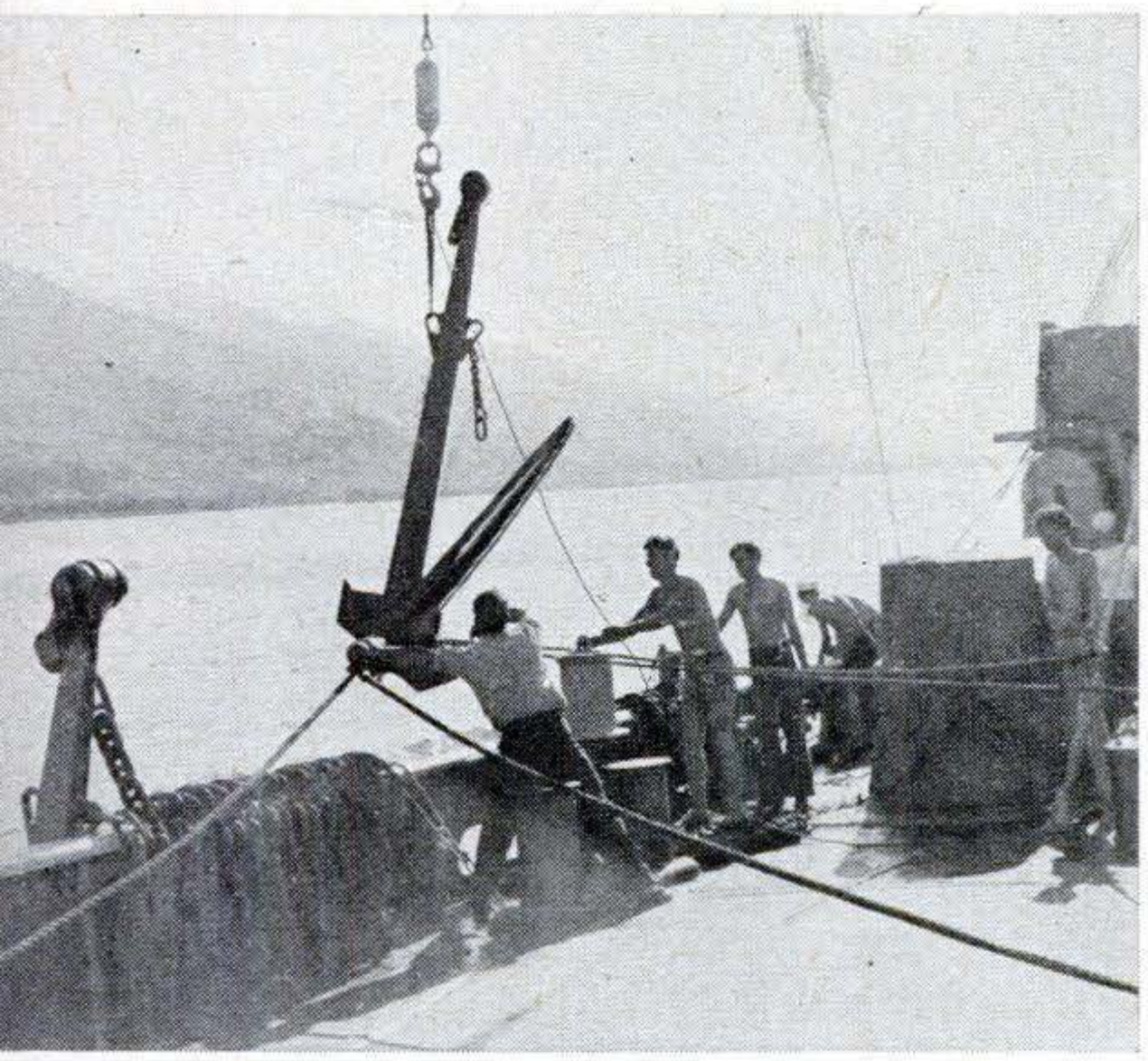
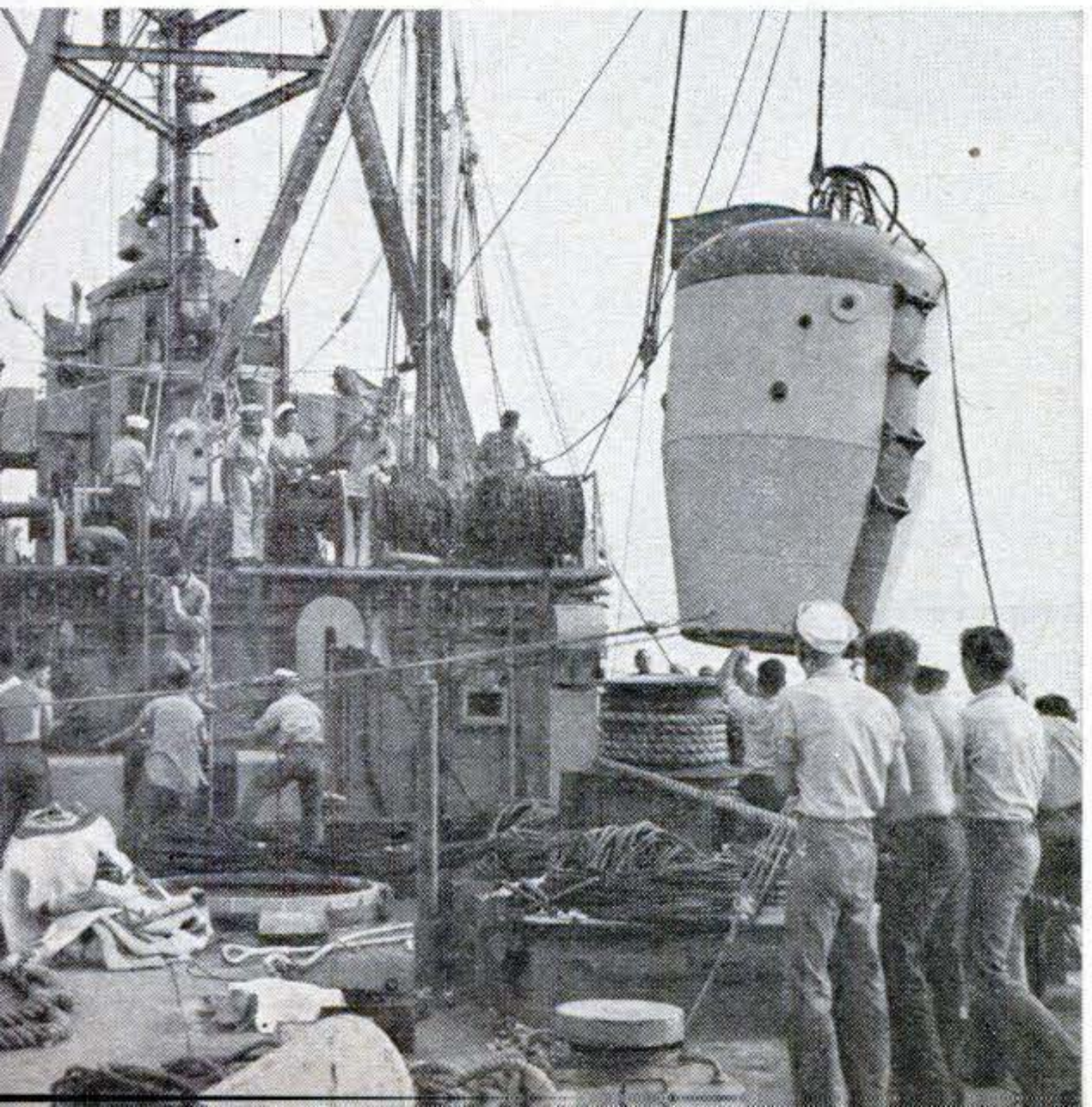
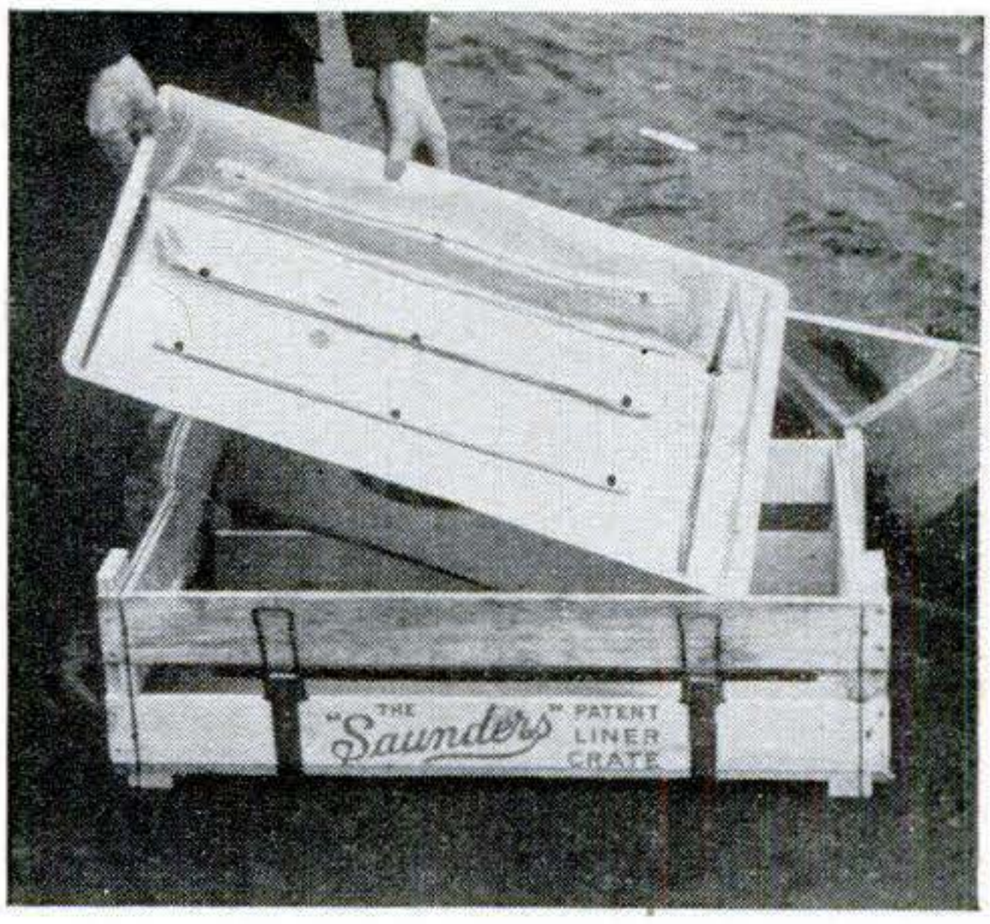
In test rescue, radio-equipped whaleboat from rescue ship searches for buoy released by a sunken sub whose general location has been established by underwater detection equipment.



Rescue area is marked by floats attached to 3,000-lb. anchors dropped at corners of 400-yard square around sub. Rescue ship centers itself over sub by 8-in. lines to the floats.

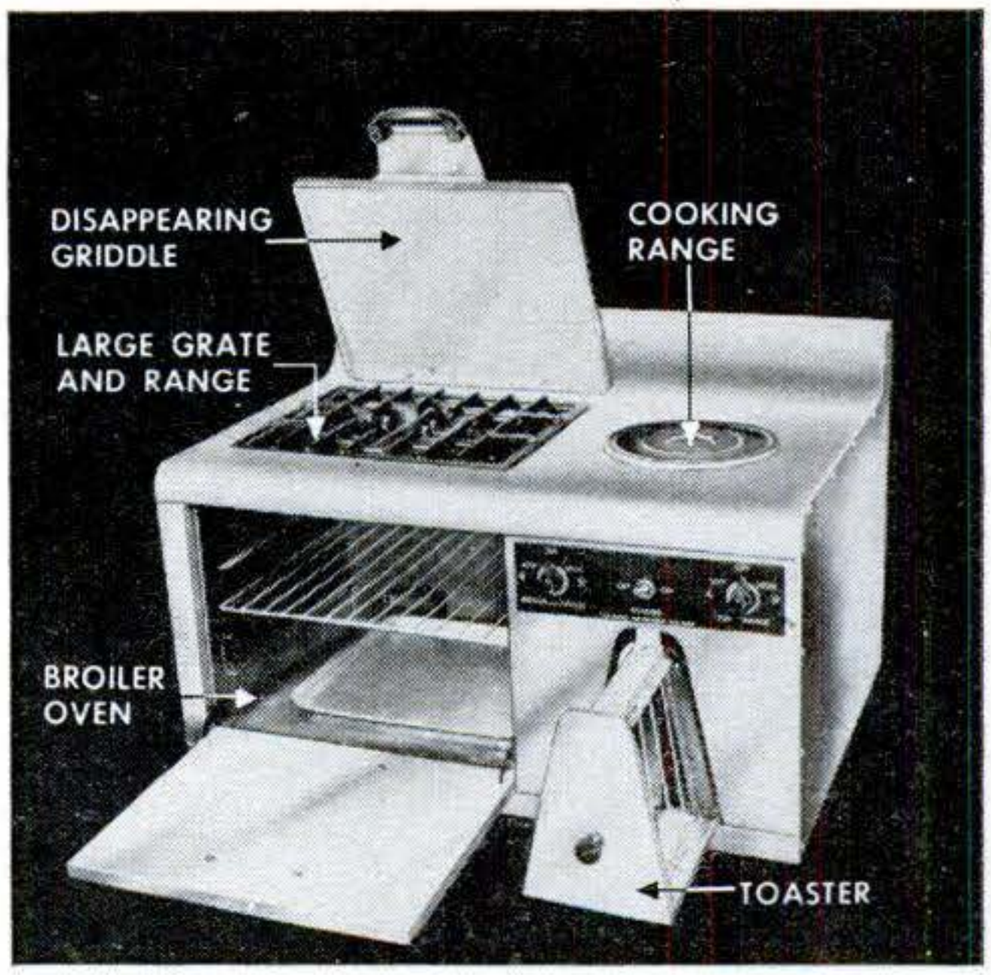
Nine-ton diving bell (below), with two-man crew, winches itself down cable brought up from sub by messenger buoy. Bell then clamps over sub's escape hatch to rescue its crew.





Fish and Crates Kept Clean

WOODEN fish crates can now be used over and over with this Saunders aluminum liner. Made in England, the lightweight liner fits inside the crate and keeps the fish from touching the wood. After each shipment, the lining can be removed, cleaned, and reinserted for use again. It is also said to keep fish cleaner in transit. A United Nations committee has recommended use of such a device for hygienic handling of fish at ports.



Pint-Size Range Has Toaster

THIS complete electric range was designed to save space in trailers, boats, and cramped apartments. Called the Ovenette®, it measures only 16 in. high, 22½ in. wide, and 15 in. deep. Besides two burners, a griddle, and an oven, the stove has a built-in toaster. This pulls out to take two slices of bread, then pushes in between heating elements. The outside is mirror-finished stainless steel.

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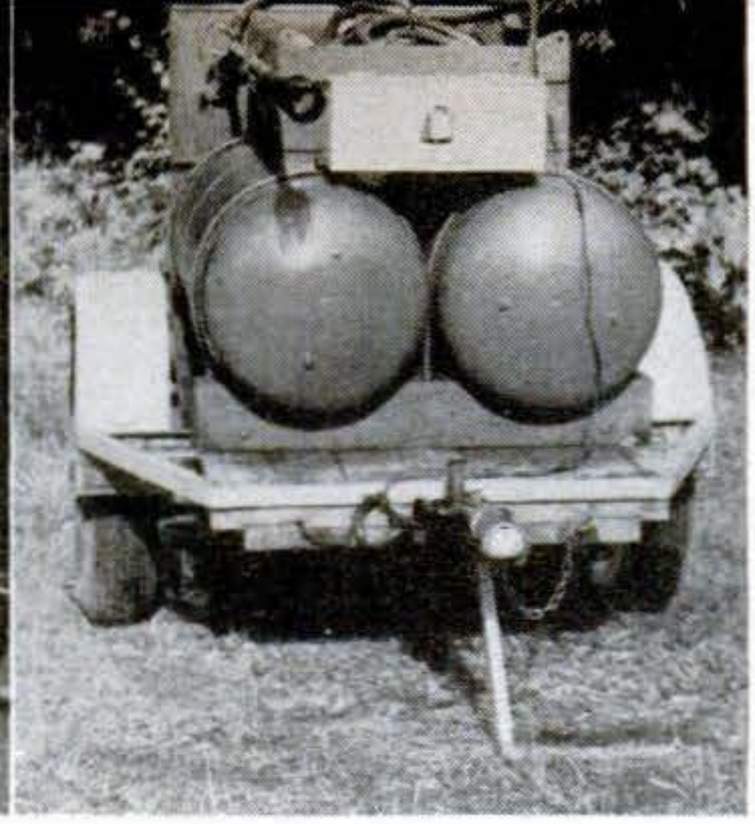
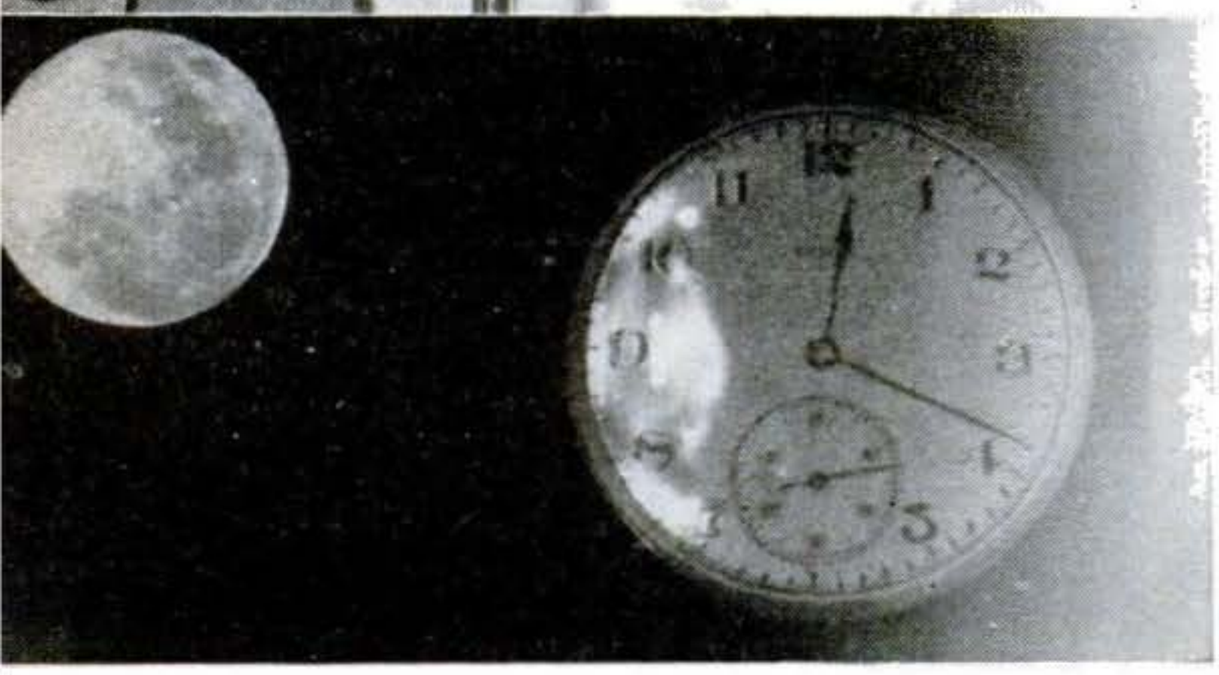


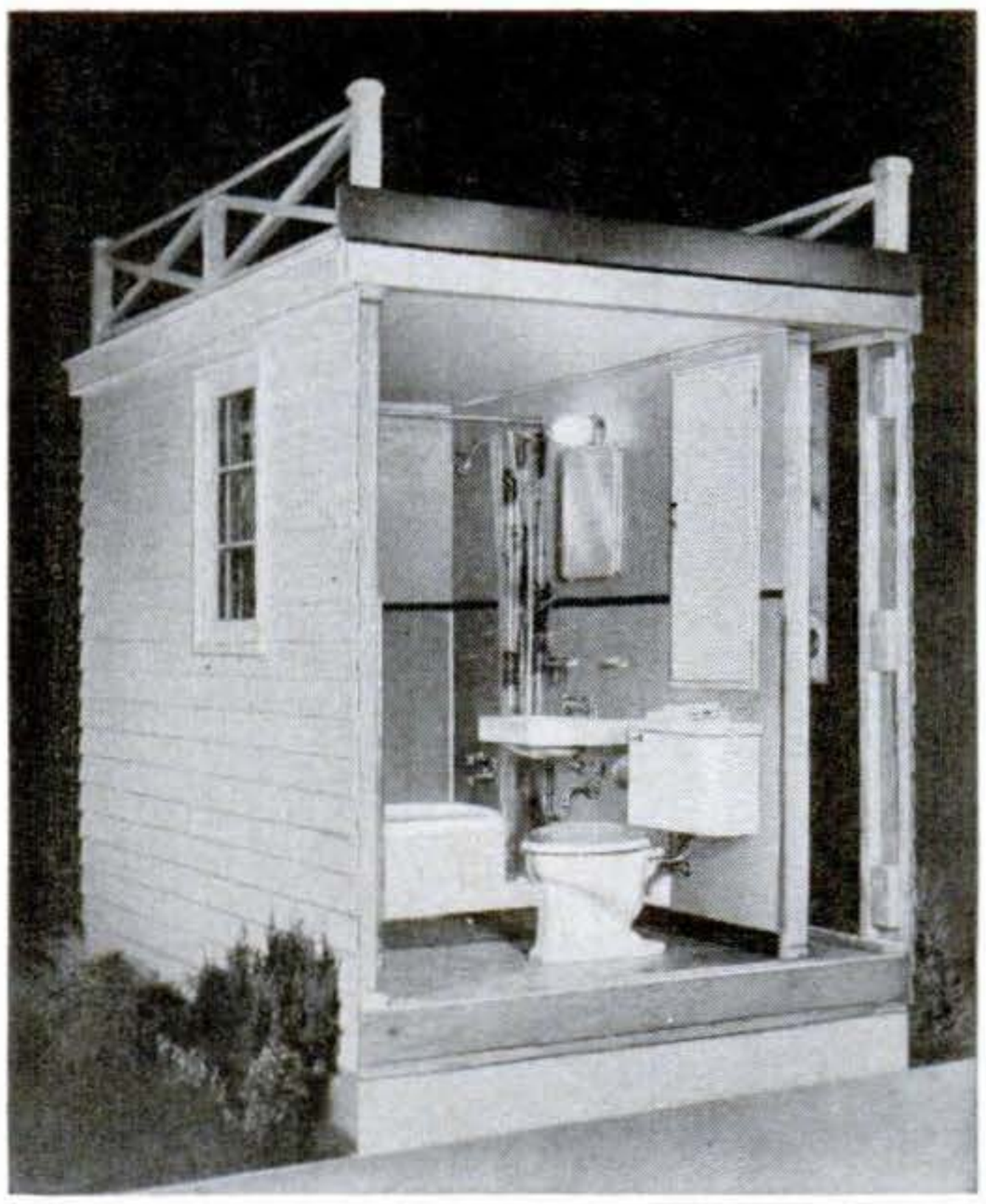
Flame Thrower Needs No Pump

In this new flame thrower, for burning brush and lumber-mill waste, the fuel itself provides the pressure to shoot a stream of fire 25 feet. Instead of a pump, it has twin fuel tanks, connected near their tops. One 48-gallon tank contains Diesel oil; the other, propane, a flammable gas kept liquefied under pressure. Through a dual hose line, the propane forces both itself and the oil to the torch under 75-lb. to 125-lb. pressure. The trailer-mounted outfit was designed by W. C. Cheney, of Seattle.



Gun Camera Shoots the Moon

A machine-gun camera once used to train Jap aerial gunners now shoots the moon for David Rotbart, above, a back-yard astronomer of Washington, D. C. Simultaneously, as shown in the lower picture, it photographs a watch face in a mirror as a record of the exact time. The camera can take snapshots one at a time or run off a reel of 35-mm. film at 10 frames a second.



Bathroom Is Prefabricated

To put in this new bathroom just attach the entire room to your house and hook up the plumbing. Called Ad-a-Bath ®, it's sold as a factory-assembled "package," complete with fixtures, built-in cabinets and electric heater, and wiring. The room, shown here with one wall removed, is 6 ft. 8 in. by 8 ft., and 8 ft. 2 in. high. It is of insulated frame construction with plywood interior and linoleum-covered floor. Price: $1,095 plus about $150 for installation, which usually takes only a day.

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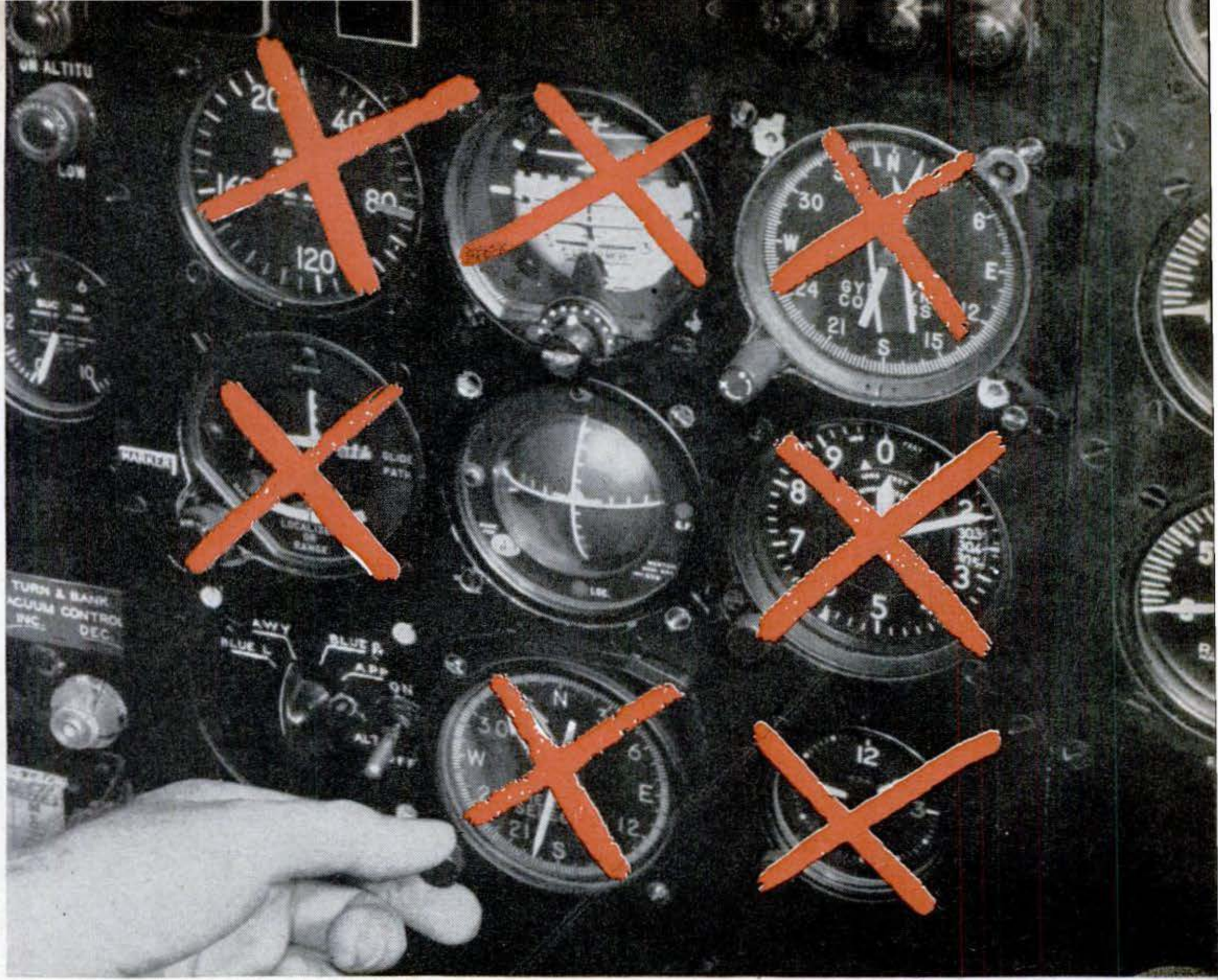

By keeping cross pointers of center dial "zeroed," the author was able to fly a DC-3 blind.

I Flew Blind— on One Instrument

When visibility is "zero-zero," this new device takes on the brainwork and lets the pilot supply only the muscle.

By Herbert Johansen

Drawings by Ray Pioch

IT WAS the kind of weather that makes you wish you'd stood in bed.

I was flying a twin-engine DC-3. There I was at 1,500 feet in a thick, soupy fog; it was raining; the air was rougher than a bronco buster's nightmare.

And this was the first time I had ever been at the control wheel of any airplane!

We were on instruments, but I was flying the plane manually, my eyes glued to a single instrument with two crossing pointers that was doing the thinking for me. When we changed the heading indicator from 230 degrees to 60 degrees—the magnetic heading of our destination, MacArthur Airport on Long Island—the control wheel fought me as I strained to keep the pointers "zeroed" for the turn. But we made it—on course—on the beam. A light flashed, indicating we were over the runway marker.

Then came a switch to "approach" to get into the glide path. We began losing altitude. As long as I kept the two pointers "zeroed"—crossed at dead center like a + mark—I was all right, but they kept swinging as I nosed the plane up and down and banked right and left. At 1,000 feet the air got rougher—and still no visibility . . . . 700 feet . . . . 500 feet . . . . it seemed endless.

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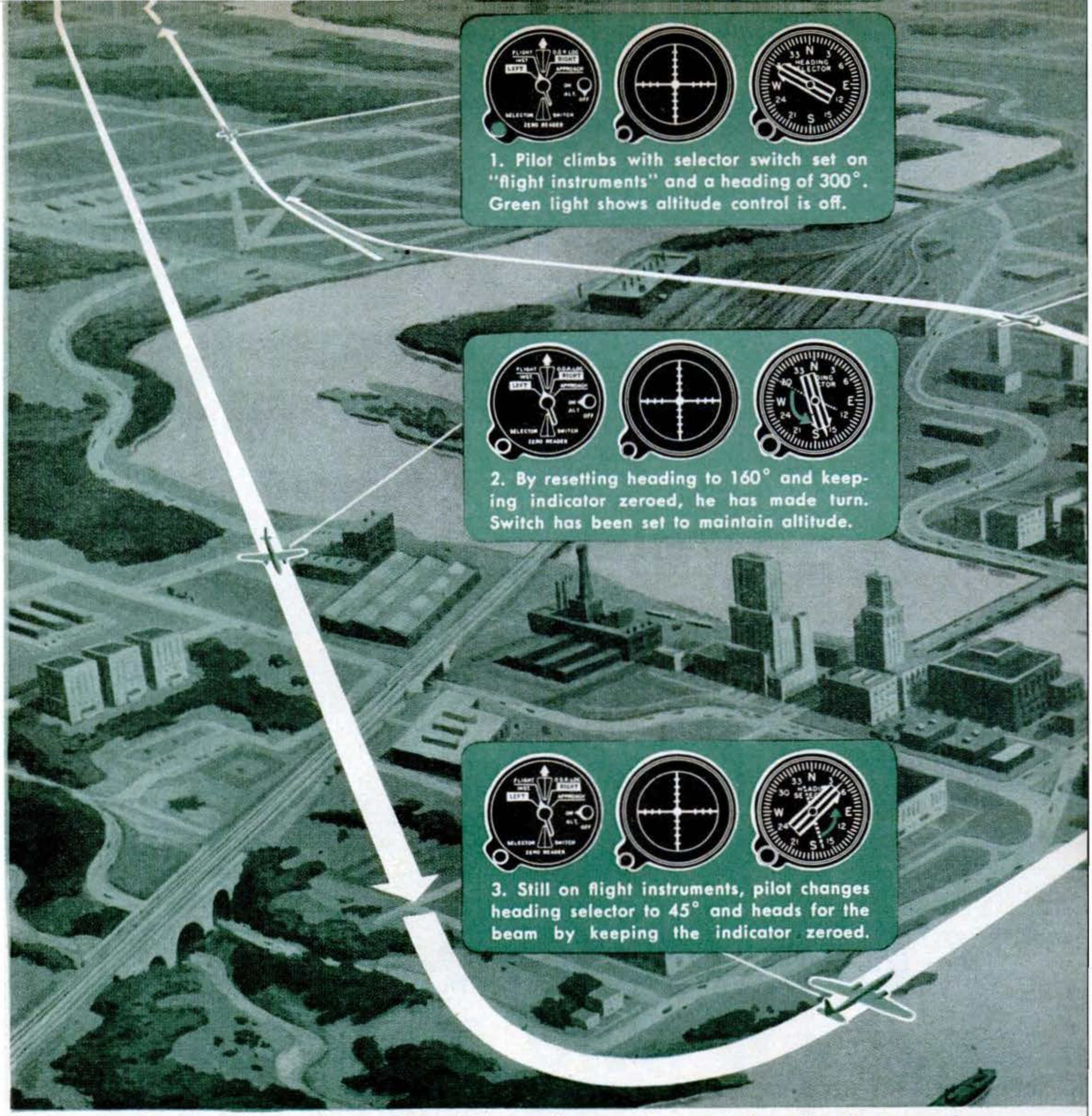

Artist's sketch shows how a plane takes off from airport at upper left and makes complete

Then, as the needle of the altitude indicator crawled toward 400 feet, we broke through the overcast. And there—straight ahead—was the runway, with the plane nosed right for it, set for a perfect landing!

We zoomed up, though. Charlie Sharp, Sperry pilot sitting in the copilot's seat, had taken over the controls. I released my tight hold on the wheel and peeled my eyes off the pointers. Behind me an engineer called into the cabin: "Okay, Samuels, you're next!"

As I squeezed out of the pilot's seat, Harry Samuels, POPULAR SCIENCE Art Director, came into the cockpit. It was his turn to fly blind on one instrument—and his first time at the controls of a plane, too.

Don't get the idea that the new Sperry electronic Zero Reader ® made either of us a pilot—it just used us as the muscles to handle the plane. It simplifies bad-weather flying, navigation, and landing under instrument conditions, but it doesn't take the place of the human pilot by a long shot. Although I was able to keep the DC-3 on course and in level flight by following the directions signaled to me by the constantly fluctuating cross pointers, Charlie Sharp was right there, keeping an eagle eye on me. He set the course we flew, handled the power setting and throttles, and took care of such important details as switching gas tanks when one was emptying.

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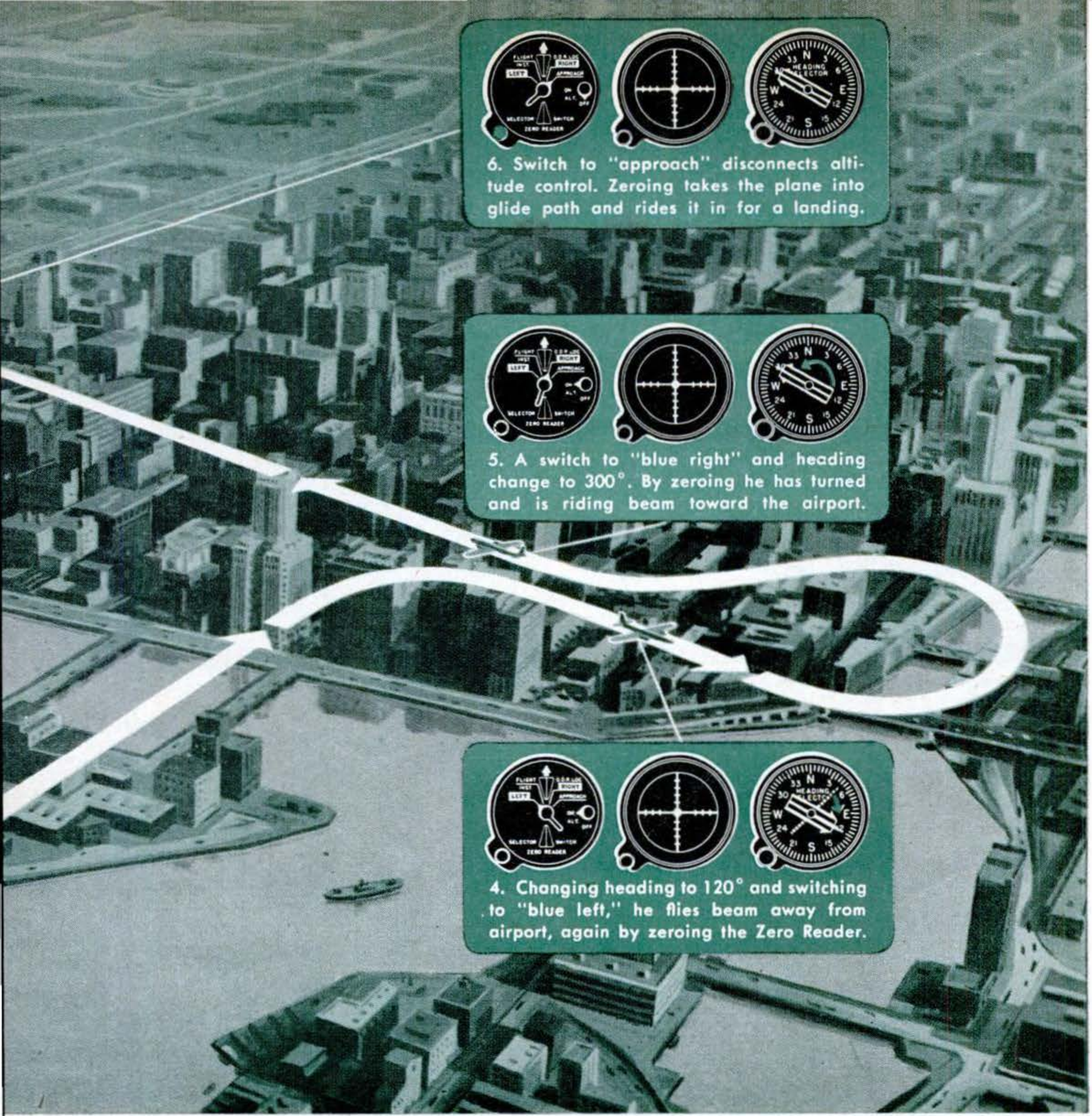

go-around and blind approach by keeping Zero Reader®, in center of each panel, "zeroed."

But the Zero Reader does take a great deal of the "thinking" out of instrument flying. It makes the calculations necessary for the pilot to *get on* and *stay on* a desired compass heading or radio track. It automatically pieces together information from conventional flight instruments and adds them up for the pilot on a simple, two-element indicator.

It tells him not only that he must make a correction, but just how much he must fly left or right or up or down to make that correction. When he has done the right thing, he knows it because the cross pointers are zeroed. He maintains altitude or makes turns almost without knowing he is doing it. And the device is expected to make possible safe manual landings at lower weather minimums than are now possible with the conventional ILS (Instrument Landing System) alone.

On the day of our flight we made half a dozen approaches and could have continued endlessly, one after the other—all routine. At the same time, commercial air traffic was practically at a standstill at La Guardia Field, a short distance away, the same rain clouds and low visibility canceling 200 flights.

This weather wasn't particularly bad for Zero Reader flying, according to Herbert C. Bostwick, Director of Flight Research for the Sperry Gyroscope Co. and one of the

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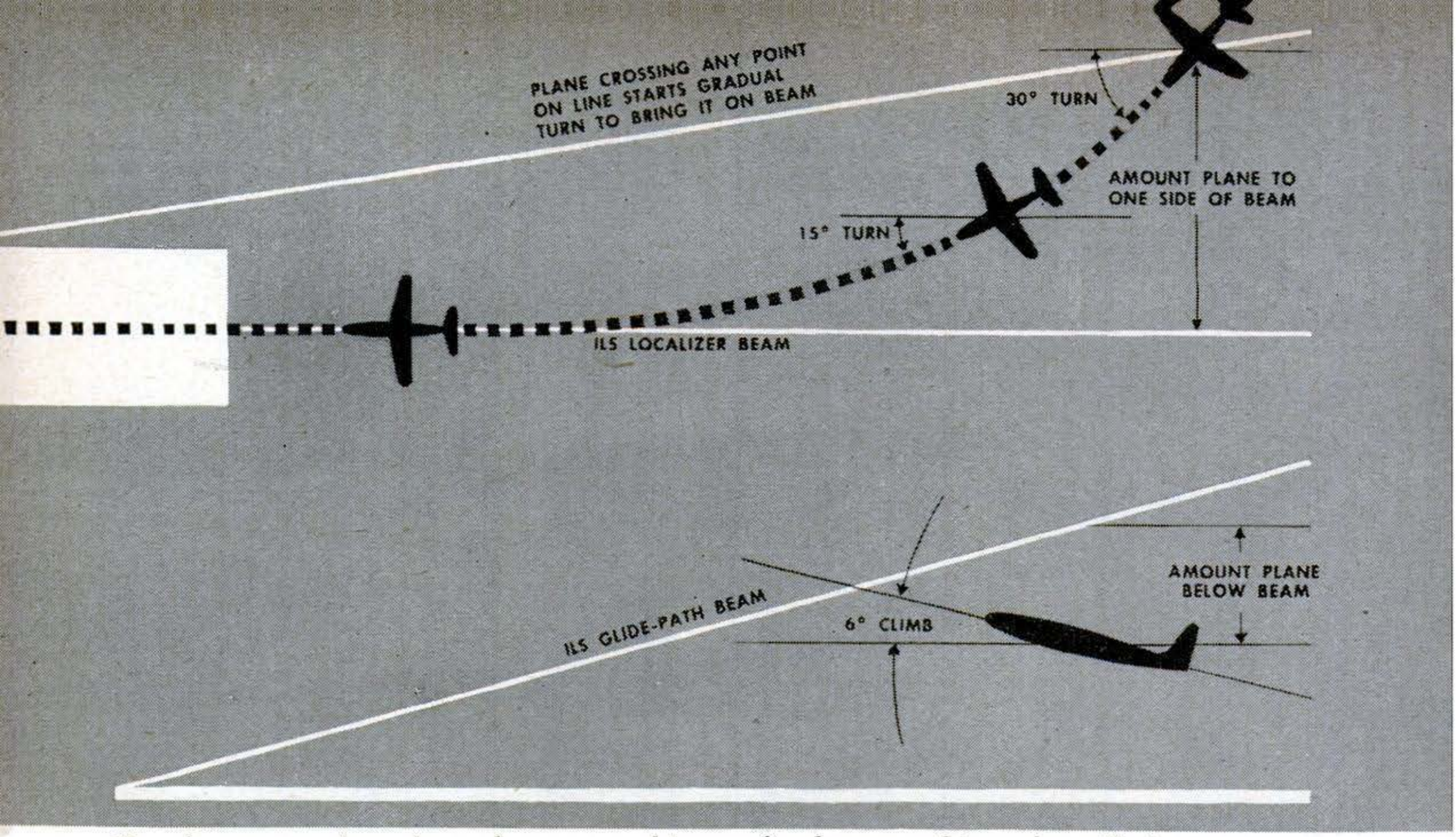

Drawing at top shows how plane approaching airport off course is guided into long, gradual curve that will bring it right on beam. Plane starts to turn toward beam at 30° angle. By keeping Reader "zeroed," pilot then automatically decreases this angle until plane eases onto beam. At midpoint between beam and original course, for example, angle is only 15°. Bottom drawing shows how plane flying below glide path is brought up to meet it in easy, 6° climb.

chief contributors to the development of the device. Sperry pilots, he pointed out, have made dozens of routine landings with the ceiling below 50 feet and close to zero visibility.

In making a standard ILS approach, the pilot must use his compass in addition to his ILS cross-pointer meter. First he must find the beam. Then, starting off to one side, he flies a compass heading that will intersect it. He must try to keep from crossing the beam by making a manual turn. But he usually does this too late and crosses the beam. He then turns in the other direction to get back on the beam, again crossing it. The amount of this weaving back and forth across the beam, called bracketing, depends upon the skill and judgment of the pilot—and often makes for missed approaches.

The Zero Reader does away with all this. It compares the compass with the cross-pointer meter and calculates a series of flight paths that will ease the airplane onto the beam no matter where the plane starts from or which heading it happens to be flying on at the start. It tells the pilot which way to turn and how much in order to get on and stay on this path.

If the flight path is disturbed by gusts or bumps, the indicator immediately shows which way to bank and turn in order to remain on the invisible road. Conventional ILS does not show an error until the airplane is actually *off* the beam. The Zero Reader shows an error as soon as anything happens that will *start* the airplane off the beam. For example, in order for the plane to get off the beam it must turn off course. But it must also bank before it can turn. A few-degrees bank will cause the Zero Reader to show a noticeable deflection. Thus as soon as one wing starts down, the indicator tells the pilot to pull it up.

Autos Have Own "Zero Reader"

"You have a sort of Zero Reader on your car," explains Glen Nesbitt, Sperry aircraft application engineer. "It's your radiator cap.

"You are driving on the right side of the road and you want to get over to the center white line. Imagine you have a hole cut in the floorboard. You turn your wheel to head left, keeping your eyes glued to the ground through the hole. When you see the white line, you know you must turn right, but it's too late for action until you have already crossed it. Then your right turn, since you can't anticipate the crossing, takes you too far, and you cross the line again, going too far to the right. This means another turn

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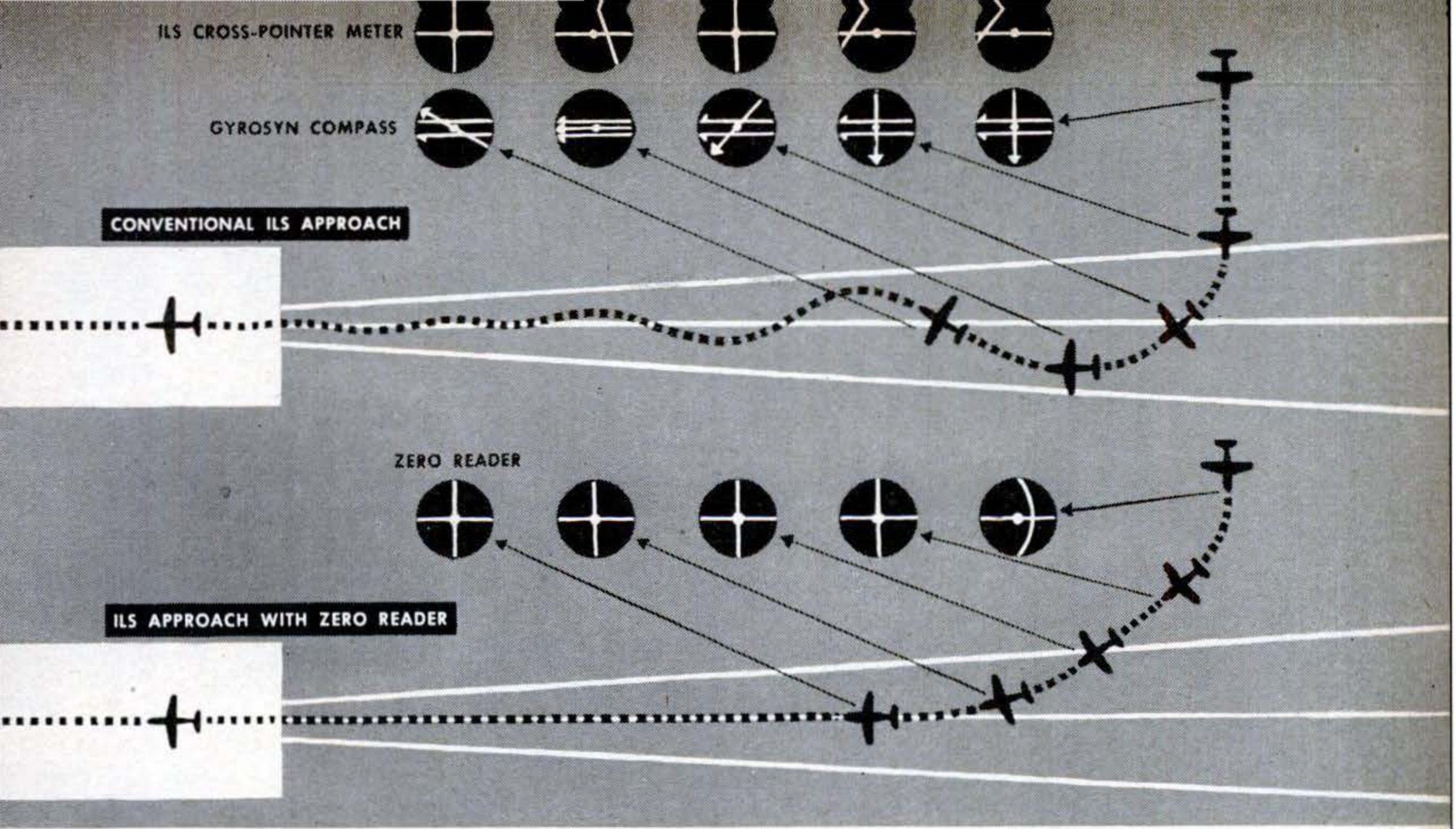

Upper drawing shows a conventional ILS approach. Using the ILS cross-pointer meter and the Gyrosyn® compass indicator, the pilot heads for the beam. But unable to anticipate intercepting the beam, he crosses it; then he has to weave back, crossing it again. This is repeated a number of times, and often he is not able to stay "on course" as he nears the runway. Result: missed approaches. In contrast is the smooth Zero Reader approach, shown in lower drawing.

to the left, and so forth. This is analogous to a conventional ILS approach.

"But," he continues, "if instead of using the hole-in-the-floor method, you use the radiator cap in front of you as a reference point as you make that first left turn toward the white line, you will be able to anticipate crossing it and straighten out before you actually do. Fortunately, in driving you don't have to worry about corrections to maintain altitude or getting into glide paths."

In addition to blind approaches and beam flying, the Zero Reader, in combination with the Gyrosyn ® compass, makes cross-country flying simple. You set the heading selector to the compass course you want to fly, then, at the desired height, flip the altitude switch. As long as you keep the cross pointers of the Zero Reader zeroed, you will maintain that course and that altitude.

Although the pilot can fly by watching and following the cross pointers alone, the Zero Reader has two other visible elements on the instrument board. One is the Course Heading Selector, which internally positions the selector Selsyn ® to the magnetic heading. The other is a switch that can be set for "blue left," "blue right," and "approach" radio-track signals. "Blue left" and "blue right" are the respective settings for outbound and inbound radio tracks from an ILS-equipped runway. The switch also has an altitude control that can be set to maintain any desired pressure altitude.

The origin of the Sperry Zero Reader goes back to the development of a "thinking" mechanism to make automatic approaches possible with the Gyropilot® (PS, Jan. '47, p. 111). This sparked the idea that an instrument could be developed to do the thinking for the pilot during manual ILS approaches.

In fact, the Zero Reader has done just that: the human pilot, relieved of the thinking, serves simply as the muscles or servo mechanisms that handle the controls in the automatic pilot.

During our last approach to MacArthur Field we came in and made a beautiful landing on the Sperry A-12 Gyropilot. And although the air was rougher than on any of our previous go-arounds, our descent was much smoother than under manual handling of the plane.

As one of my colleagues remarked to me: "You did very well on your trick up front, but for my money, the combination of Johansen and the Zero Reader will never replace the Gyropilot." END

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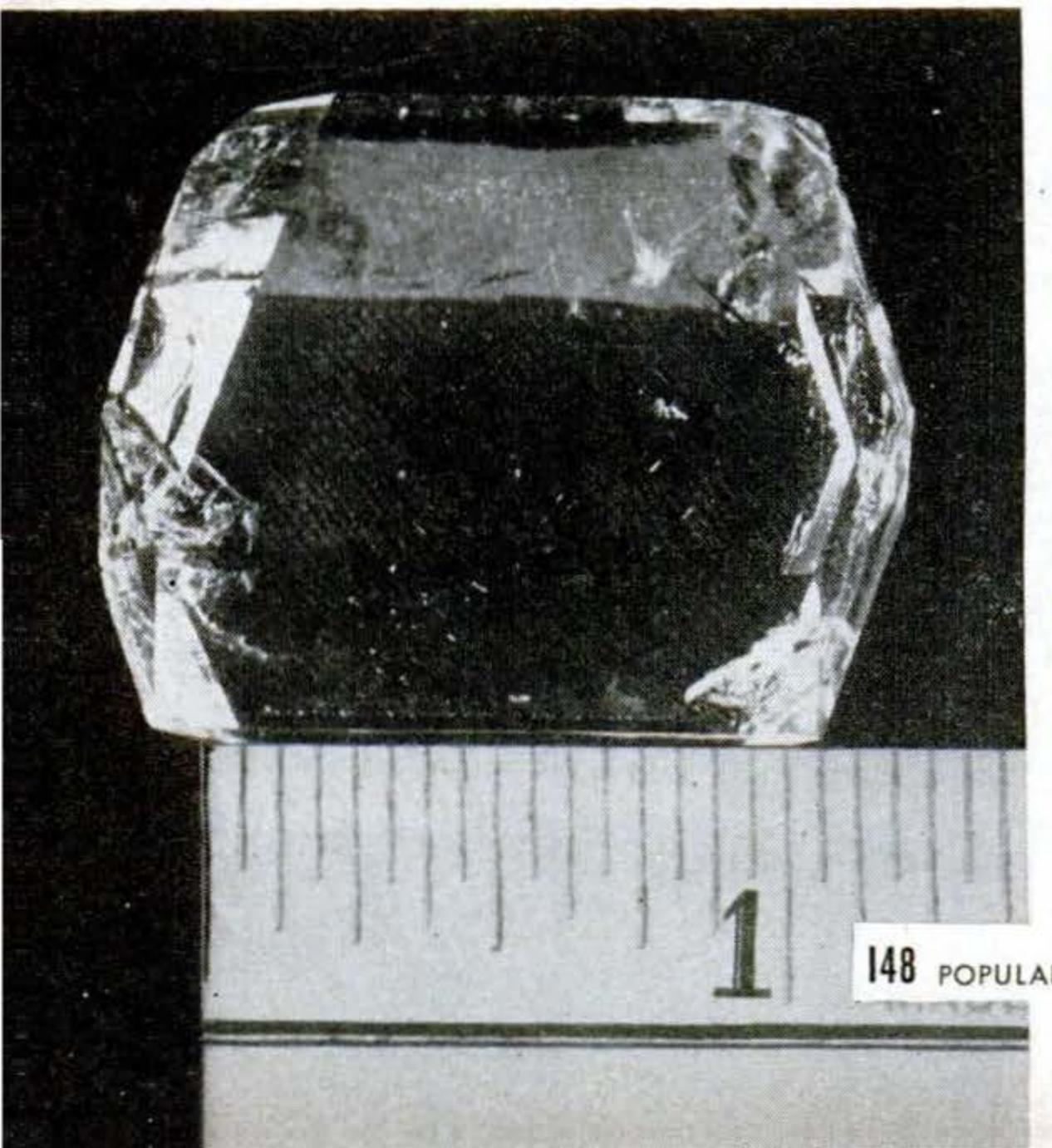
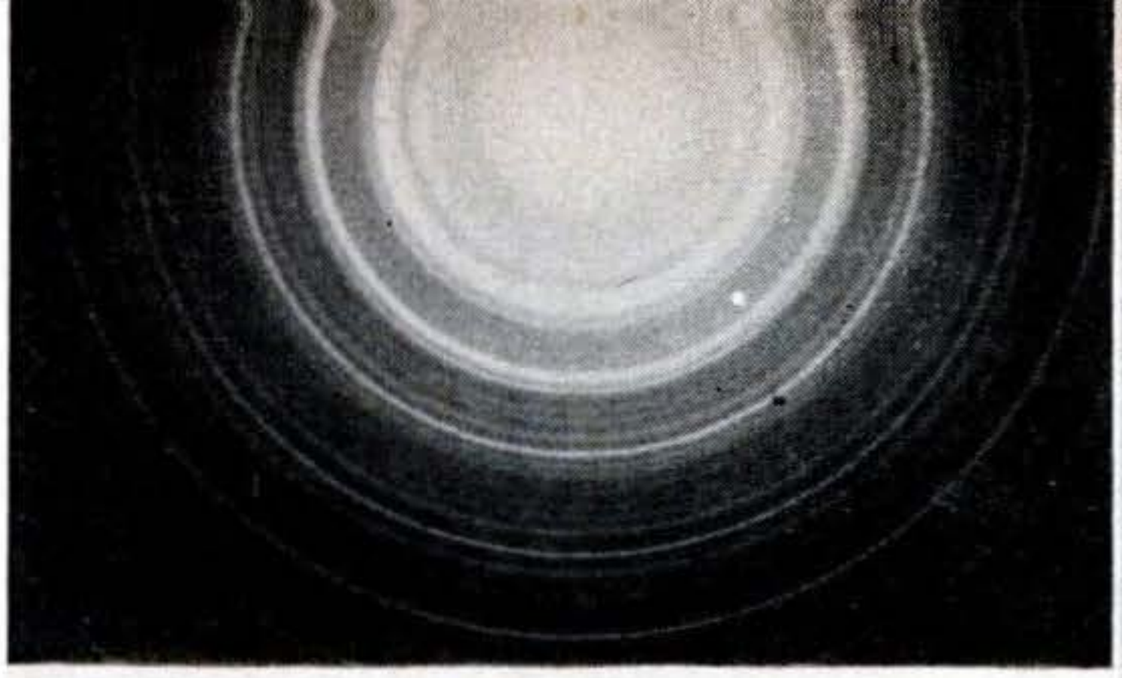
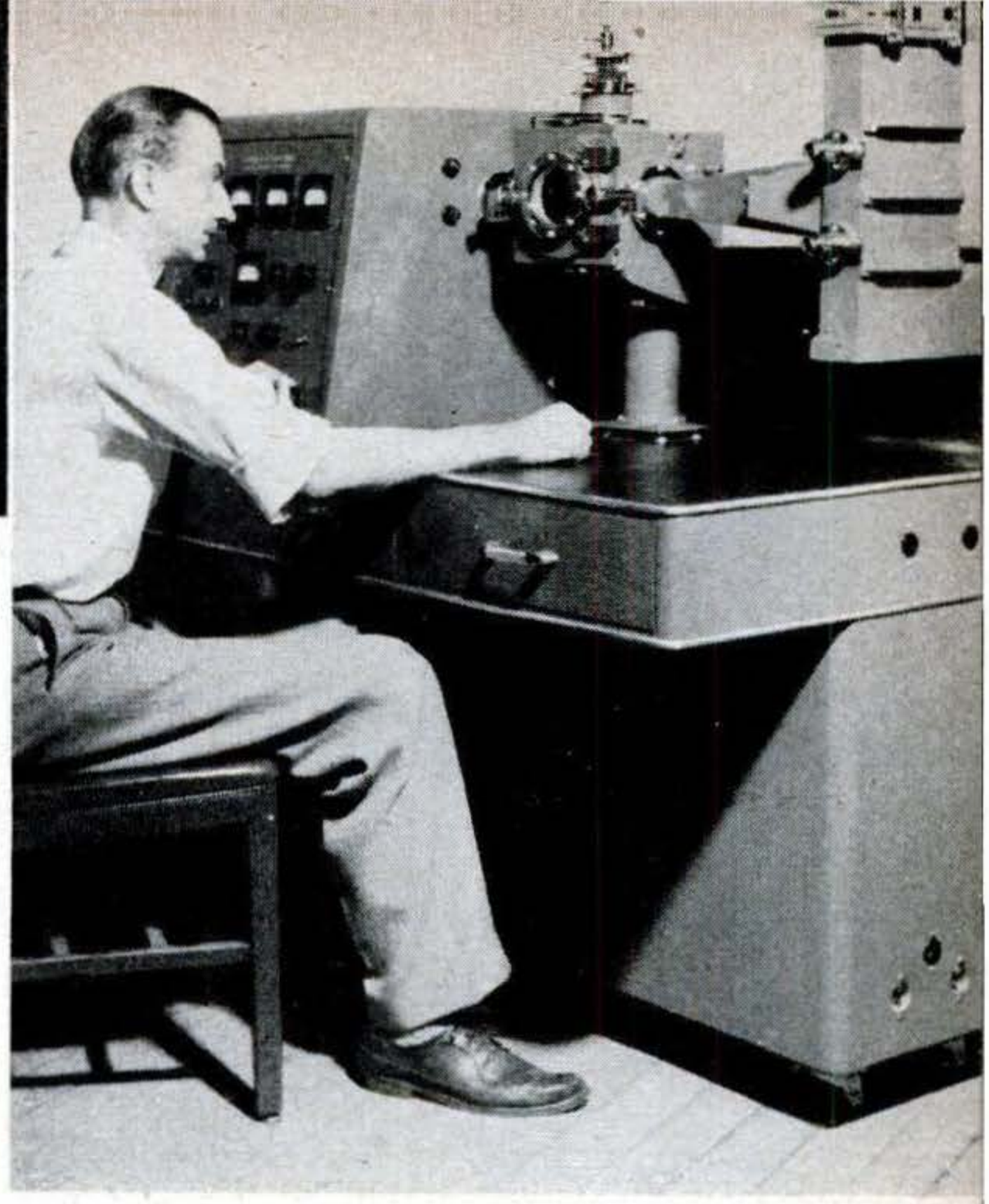
New X-Ray Rival. These Ford workers are putting a capsule of cobalt 60, an isotope from an atomic pile, inside this big casting. Gamma rays from it will produce a picture on film attached to outside. Radium could also be used this way to examine castings too big or oddly shaped to be X-rayed, but radioactive isotopes are now cheaper.

Record Crystal. Shown below is the biggest nearly perfect quartz crystal ever produced by man. It was "grown" from a solution under heat and pressure for the Army Signal Corps by the Brush Development Co., Cleveland, Ohio. Synthetic quartz crystals are used to control radio frequencies. They may end U. S. dependence on imports of natural crystals from Brazil.

Cackle Track. Sound recordings keep track of egg laying at a Kirkland, Wash., ranch producing pedigreed White Leghorns. Using a portable mike and handy wall plugs on his rounds of the nests, a checker (below) reports each hen's performance and number to a central wire recorder. The hen herself may add a triumphant cackle. This is ignored when record is transcribed to cards.





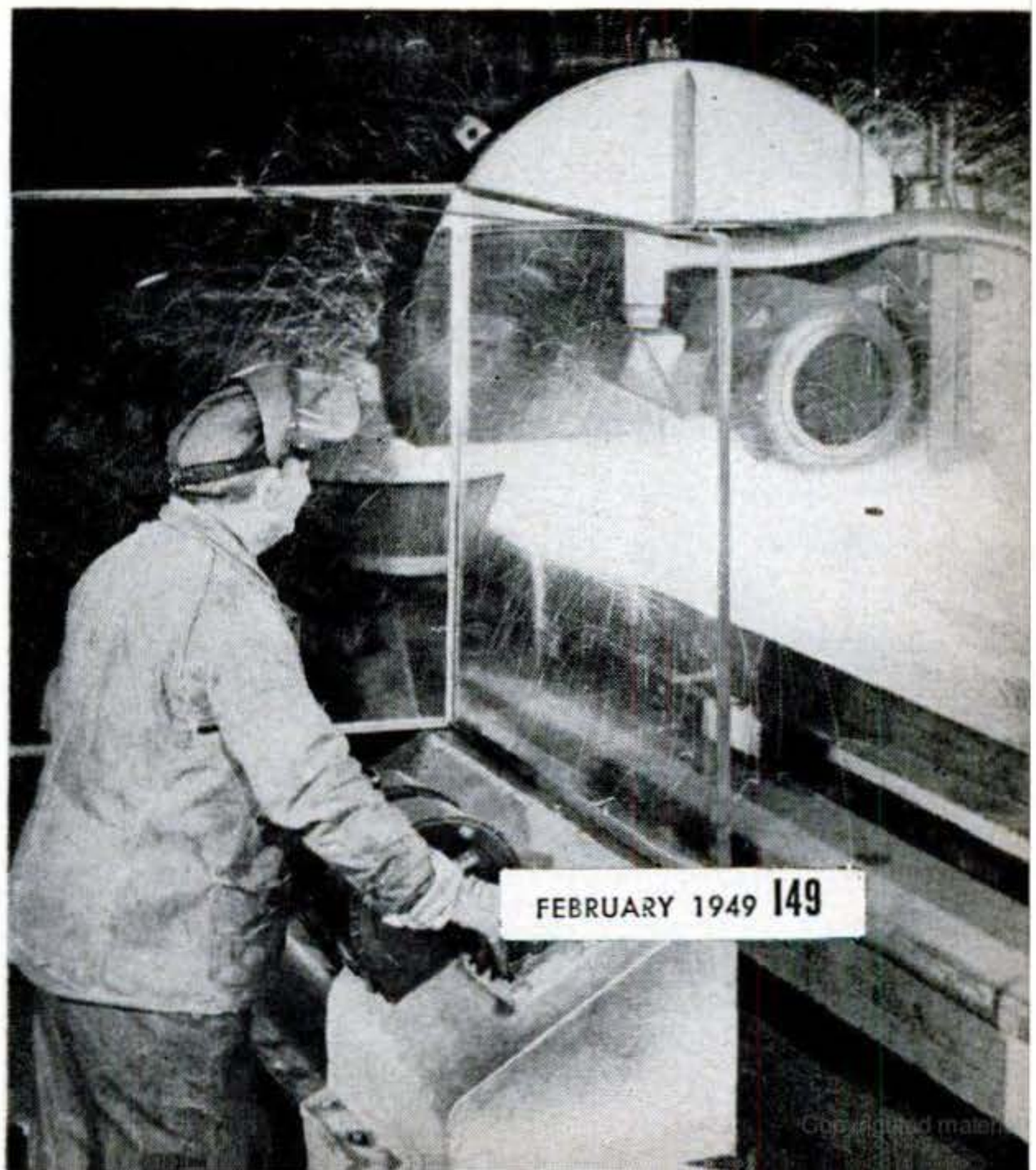


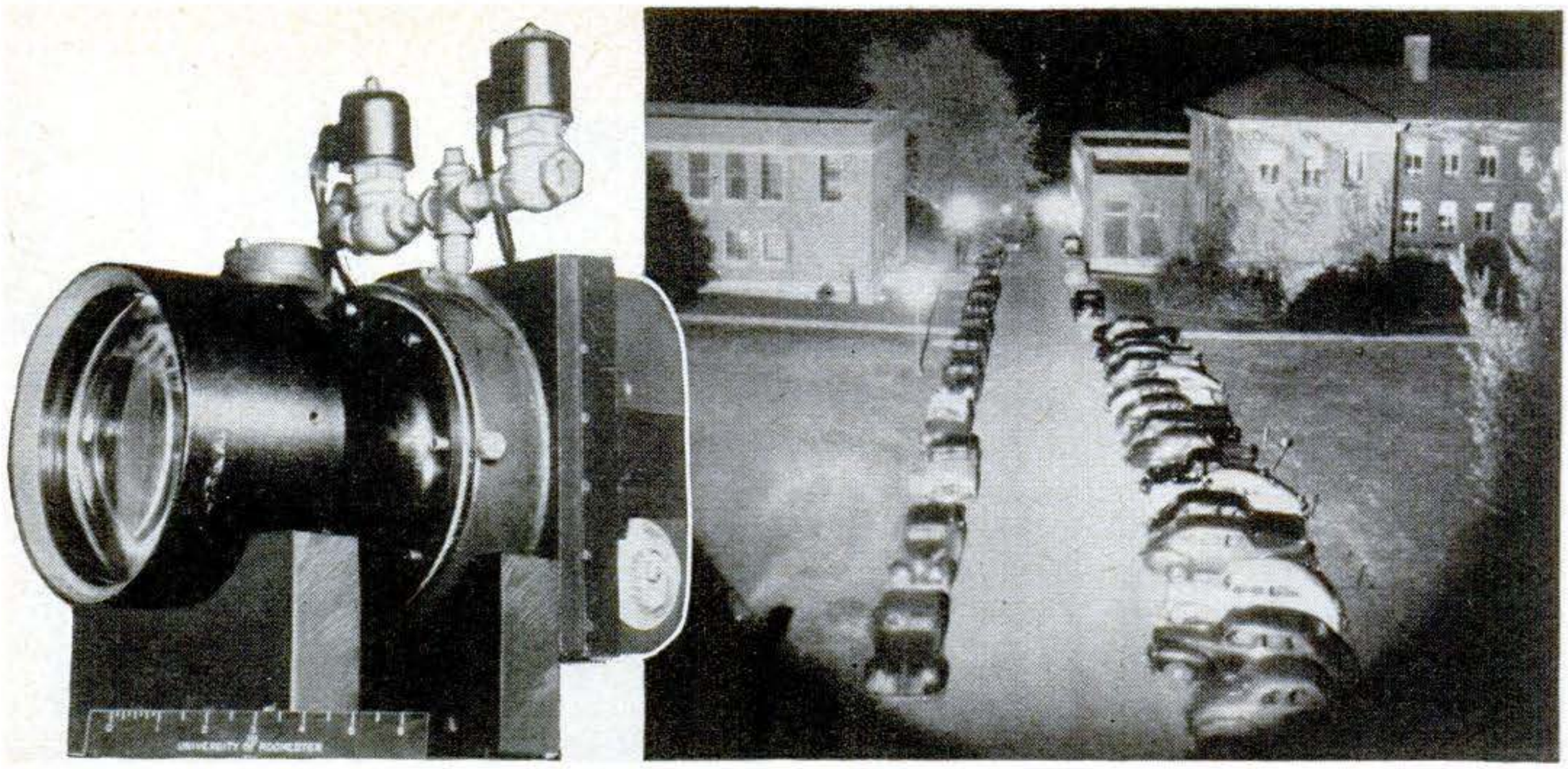
Electron Camera. Better lubricants for jet engines, longer-wearing metals for bearings, and improved chemical catalysts are being sought with the aid of the new GE electron-diffraction camera at right. It reveals the composition of a sample, and detects chemical changes, by the pattern of concentric rings obtained when a specimen is filmed. To a chemist, the typical picture above, for example, is the easily recognized "fingerprint" of iron plus two of its oxides.

To make such pictures, electrons "boiled off" a white-hot tungsten filament are focused by a magnetic lens, in the cabinet at left of the instrument, upon a specimen in a chamber at its center. Transmitted or reflected, according to the method of examination chosen, the electron stream then strikes a film, in the box at right, or a fluorescent screen. High vacuum throughout the apparatus gives the speeding electrons a clear path. The camera has been used to study a specimen less than 1/4,000,000 in. thick.

Gold-Plated Germs. Strikingly clear pictures of germs almost too small to be seen, even with the electron microscope, now are obtained by "plating" them with gold. Particles of the precious metal deposited on the specimen from an oblique angle, by a special technique, make details stand out in sharp relief. Below, the method yields one of the best "flu" virus pictures yet made.

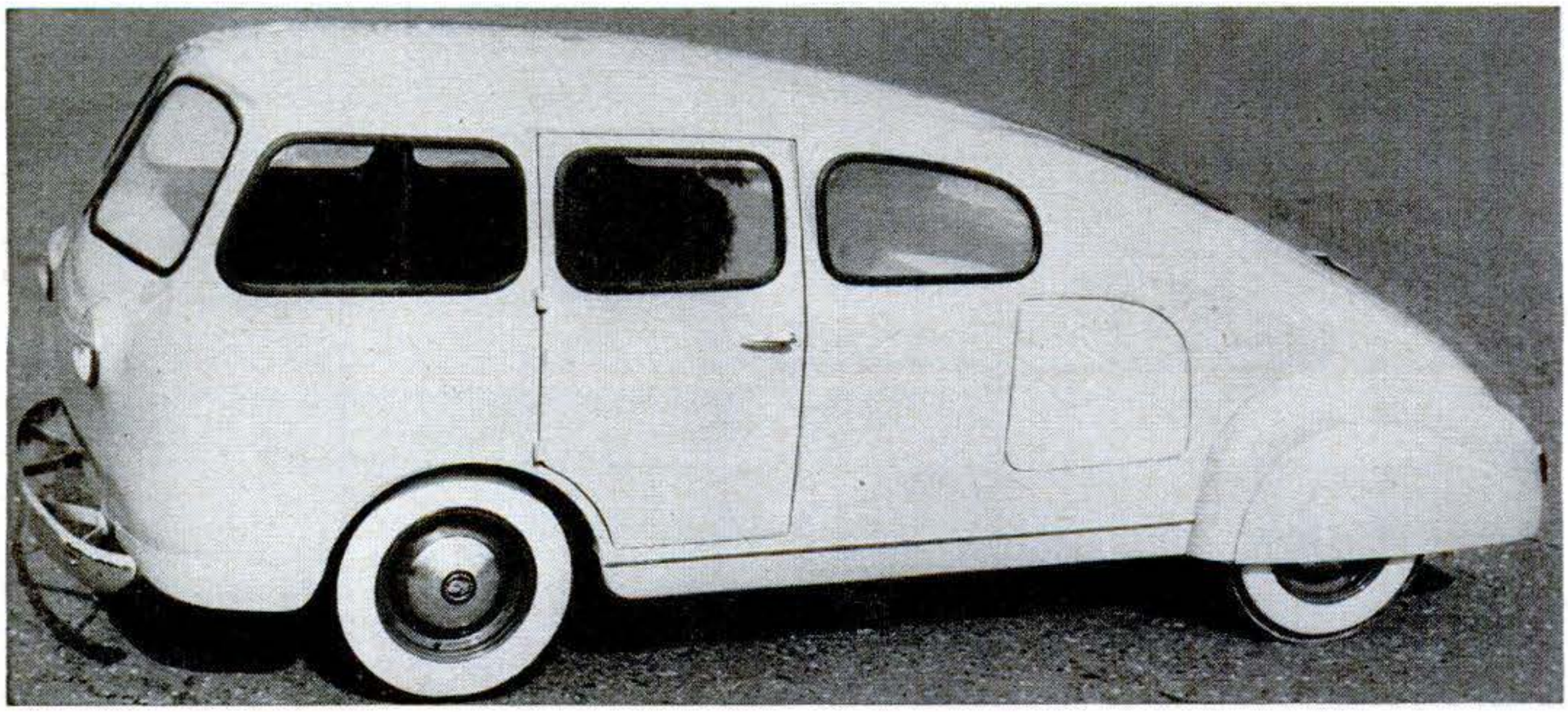
Friction Saw. Whirling at 1,750 r.p.m., the new saw below, developed by U. S. Steel, makes square, burrless cuts across heavy structural steel at a rate of 13 ft. a minute. Its blade is a disk of mild steel 60 in. in diameter and ½ in. thick, rimmed with teeth that travel 320 m.p.h. Friction against hard steel generates enough heat to melt it, and the teeth carry it away.





Camera with F/1 Lens Needs Little Light

THIS new camera took the night photo at right above by the light of a single No. 22 flashbulb. The sharpness of objects up to 600 ft. away was achieved with an f/1 lens of 6-in. focal length, which gathers 2½ times as much light without loss of image quality as any previous lens. The high definition right out to the rim of the 36° field results from the camera's curved image surface. Roll film is stretched against a concave metal plate by compressed air valved into a chamber between the film and the rear element of the lens. The 55-lb. camera was developed for the Air Force by the University of Rochester for night aerial photography.



New Low-Cost Car Built of Prefabricated Parts

HERE's a six-passenger sedan for $1,235—if you can get it. A Seattle garageman, Roy McCarty, assembled this first test model of the new Mustang ® mostly from prefabricated parts: Hercules engine, Budd wheels, Warner transmission, Spicer rear end, aluminum body by Pacific Car & Foundry.

Now he has organized a company to make more like it, but is limiting orders to as many as he is sure it can get parts for.

The four-cylinder, 59-hp. engine is mounted behind a 5-ft. 9-in. rear seat designed for four people. Two separate front seats turn at right angles for access to the doors. The car is 5 ft. 1 in. high, has a 102-in. wheelbase, weighs 2,200 lb., can do 65 m.p.h., and is said to go 25 to 35 miles on a gallon of gasoline.

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Researchers at a unique school are studying the behavior and emotions of Man's Best Friend for clues to what makes people tick.

Science Tries You Out on the Dog

By Herbert Yahraes

PS photos by W. W. Morris

DO YOU get nervous in strange surroundings? Fidget when you try on a new suit? Pull your ear or wiggle your shoulders when you sit down to take an exam? Most dogs do, too. And because they do, science expects to learn from them something about your behavior.

On the rolls of a "school for dogs" at Bar Harbor, Me., is a black cocker spaniel rated by her scientist-instructors as "the closest thing to a dog genius we have yet found."

Like most of the other dogs in this curious school, she is known only by number; hers is 701. Her record stamps her as thoroughly ordinary, up to a point. She was born Dec. 23, 1947. Placed on the scales the next day, she rolled on her back, tucked her tail between her legs, and whined—like most other day-old pups. When she was two weeks old, she blinked her eyes at a flashlight; at four weeks, she was startled by the noise of a whistle. Her five brothers and sisters reacted the same way.

The first hint that 701 might be unusual came when she was six weeks old and took the barrier test, the first of a series of dog I.Q. exams. The little black dog got around the barrier in 60 seconds flat, well above average for the litter. Seven weeks later she scampered through a long maze in 15.8 seconds, the group's best time. And at the age of nine months, in a memory exam, she rated three times better than any other dog tested.

You, if you have a way with animals, probably could do wonders with this unusually intelligent dog, but the Bar Harbor school isn't trying to train her. All it wants is to find out what's back of her behavior. It wants to learn the same thing about the rest of its 90 enrollees.

And what the school is learning makes a fascinating start towards finding out more about people. One of these days it hopes to tell you why, for example, one child gets along better than another and why one per-

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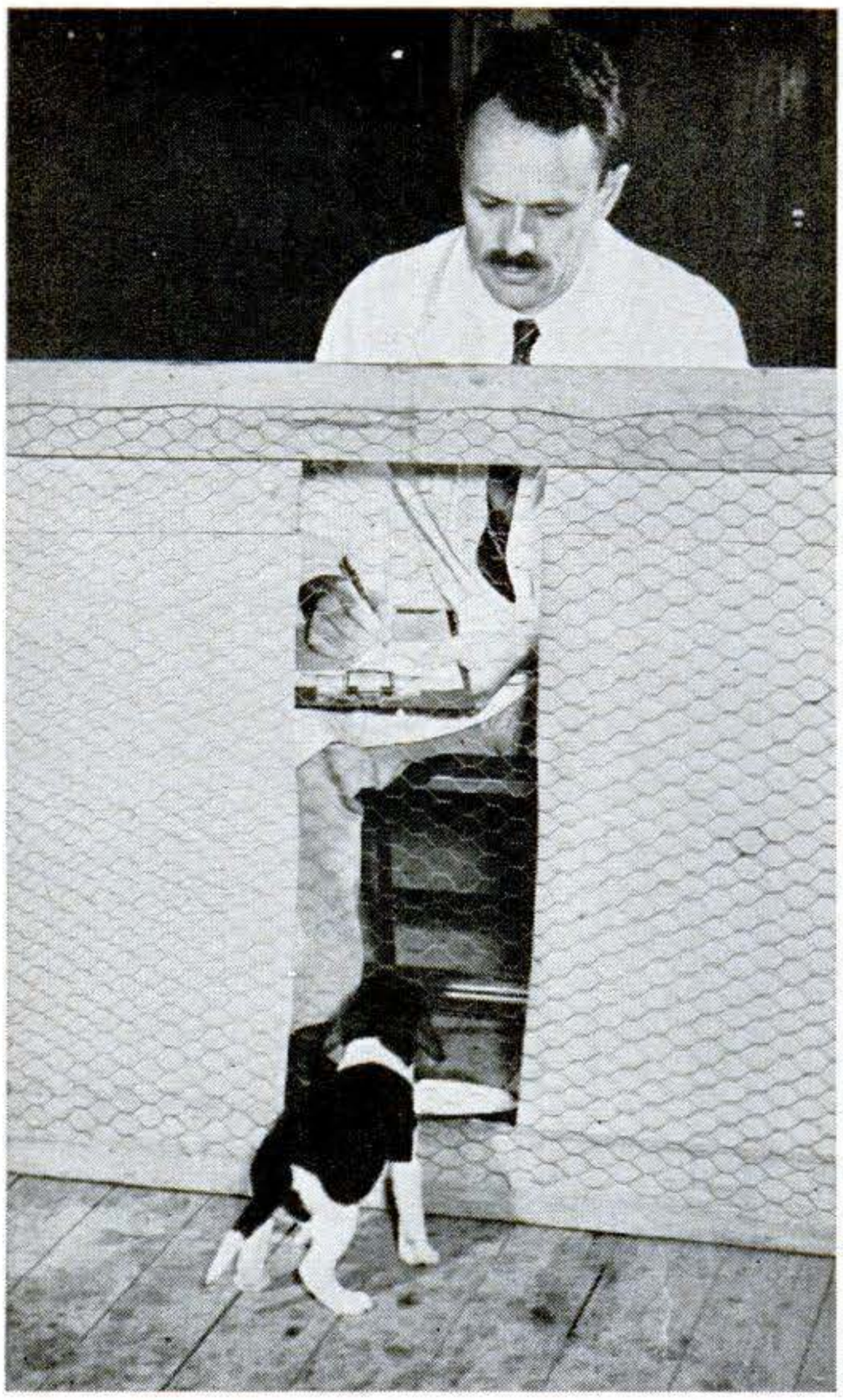

Barrier test: Examiner notes how long 6-weeks-old beagle takes to figure out he can't reach food through window but must go around end.

son becomes a Milquetoast and another a bully. And with science beginning to take more interest in what makes people tick, there is hope that it can eventually teach us not just how to win wars but what to do to make wars unnecessary.

The Bar Harbor school was set up three years ago by the Division of Behavior Studies of the Roscoe B. Jackson Memorial Laboratory. It chose to work with dogs because, as you've probably noticed, they act a lot like human beings. Besides, they vary more sharply in behavior than any other domestic animal except, possibly, man. This second reason was highly important, because the division wants more than anything else to learn whether differences in behavior in animals—including man—are influenced more by heredity or by environment.

The division's chairman, Dr. J. P. Scott, a young geneticist, began by establishing a nursery school, housed in six well-lighted rooms each about as large as a medium-size kitchen. These run along a corridor in an office-laboratory that used to be a barn.

Here, from birth until they are 16 weeks old, the pups live in an environment much like that of a human family except that the father is absent. All breeds are raised exactly the same way, so that any differences among them cannot be attributed to differences in the way they were brought up.

Every day except Sunday a young woman

Confidence-Timidity in Strange Environment
(Score ranges from 20 to 0, confident to timid)

Date Oct. 14, 1948 Place Lab

Time 1:50 PM Test Barrier

Temp. 68°F Breed Beagle

Pup No.	Score	Food				Attitude					Activity				Defec. or Urinate	
		Snaps eagerly (3)	Tastes (2)	Tries taste thru wire (1)	Eats (3)	Crouching (0)	Erect (3)	Tail down (0)	Tail norm. (2)	Tail wag (3)	Time till first moves +	Slow (2)	Med. (3)	Fast (3)	Pres. (0)	None (4)
778	11		✓		✓					✓	0		✓		✓	
775	8				✓	✓		✓	✓		5		✓		✓	
779	14		✓		✓	✓			✓		0		✓			✓
780	16	✓			✓		✓	✓			0		✓			✓

Report card scores pups on their confidence or timidity during barrier test. No. 780—the young beagle shown taking the exam in photo at top of page—scored 16 out of a possible 20 points.

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visits each classroom and spends ten minutes recording puppy behavior in as much detail as a psychologist in a nursery school making notes on how children behave. And several times a month she and Dr. Scott administer tests to see how the dogs react to strange smells, sounds, and light, and how they respond to human beings.

Scott tells you that such observations and tests show that a dog's most impressionable period comes not right after birth but between the ages of three and a half and six weeks. This seems to be the critical time for determining how the animal will get along with you. Handle it roughly, or holler, and you may give it a lasting scare. Try to house-break it by harsh methods, and it will learn nothing except to be afraid of you.

These findings may be important in the way you ought to handle children as well as puppies. Scott points out that the most impressionable period in a baby's life is supposed by many psychologists to come before and immediately after birth. The work with puppies suggests that a baby's impressionable period may fall much later, between the ages of 18 months and three years.

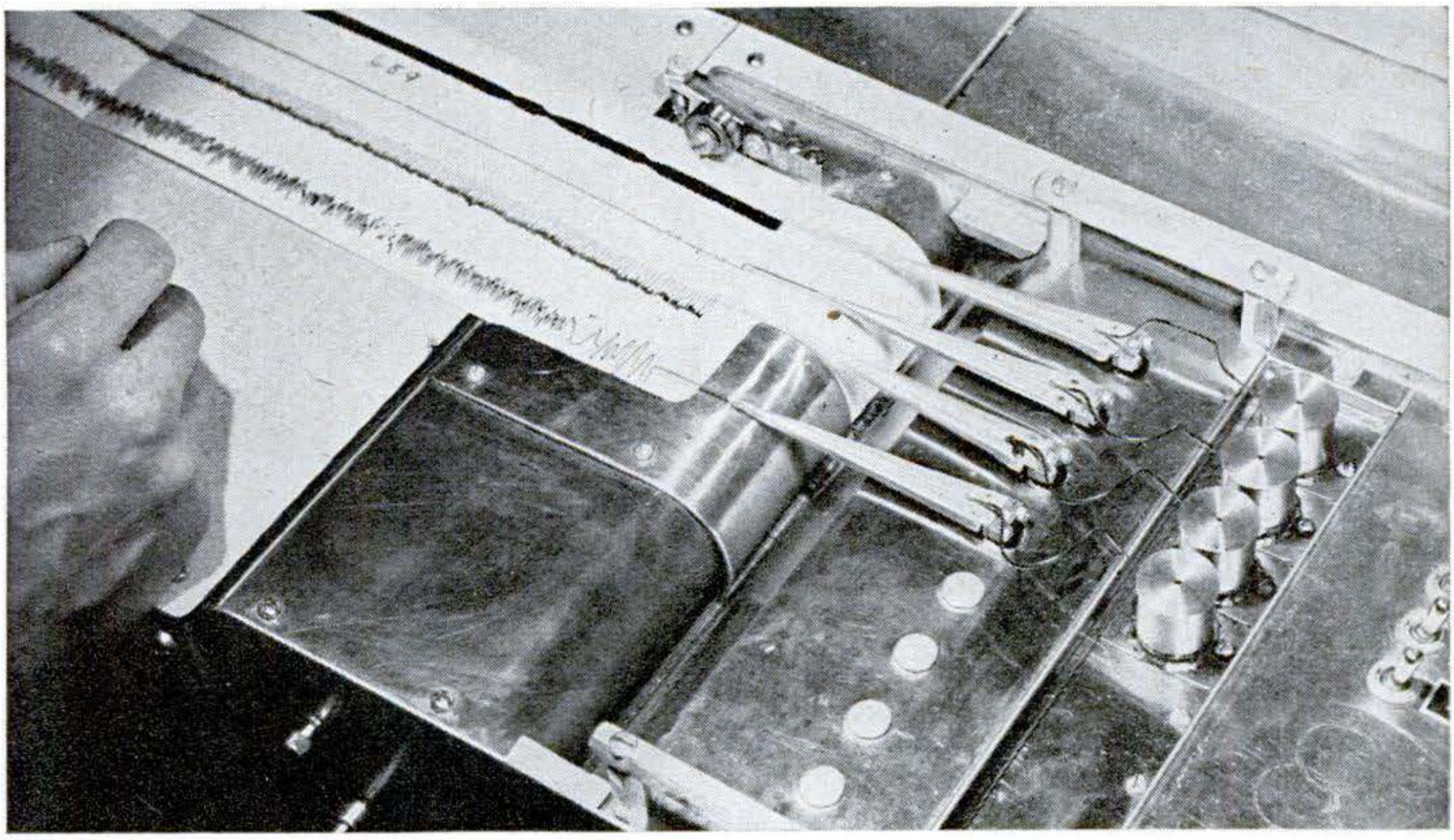
Ever wonder if a dog's way with a bone showed anything? Scott uses it to measure aggressiveness. He clears the room of all but two pups and puts a bone between them. The pup that picks it up and holds on is rated the more aggressive, or dominant.

This characteristic may help explain the dog's behavior later on in life; so his dominance ratings are carefully kept, along with all his other scores, in a file that is bulkier by the time he's a year old than all the report cards you ever accumulated. Foolish? Listen to Dr. C. C. Little, director of the Jackson Laboratory, who was once president of the University of Maine and then of the University of Michigan.

"The ordinary school," Dr. Little says, "pays a good deal of attention to your intelligence, and hardly any attention to your emotions. And it's your emotions more than your intelligence that determine how well you're going to get along. We're trying to find out just how the emotions are influenced."

Already the dogs' report cards offer some tips. For example, they show it is usually the less aggressive animals who get along best in strange circumstances and make the best scores in the mental tests. Smart No. 701 was one of the least dominant members of the litter; if the other dog wanted to take the bone, that was usually quite all right with 701. Yet in the barrier test, she quickly figured out that she had to go around the end of the barrier to get food, while the more aggressive dogs tried to reach it by breaking through the window.

No. 701 ranked low in timidity, too. Although she wouldn't fight over a bone,



Recorder writes wavy-line report of dog's reactions to possibly frightening situations. Top line shows head movements; second, muscular twitches; third, heart rate; bottom, respiration.

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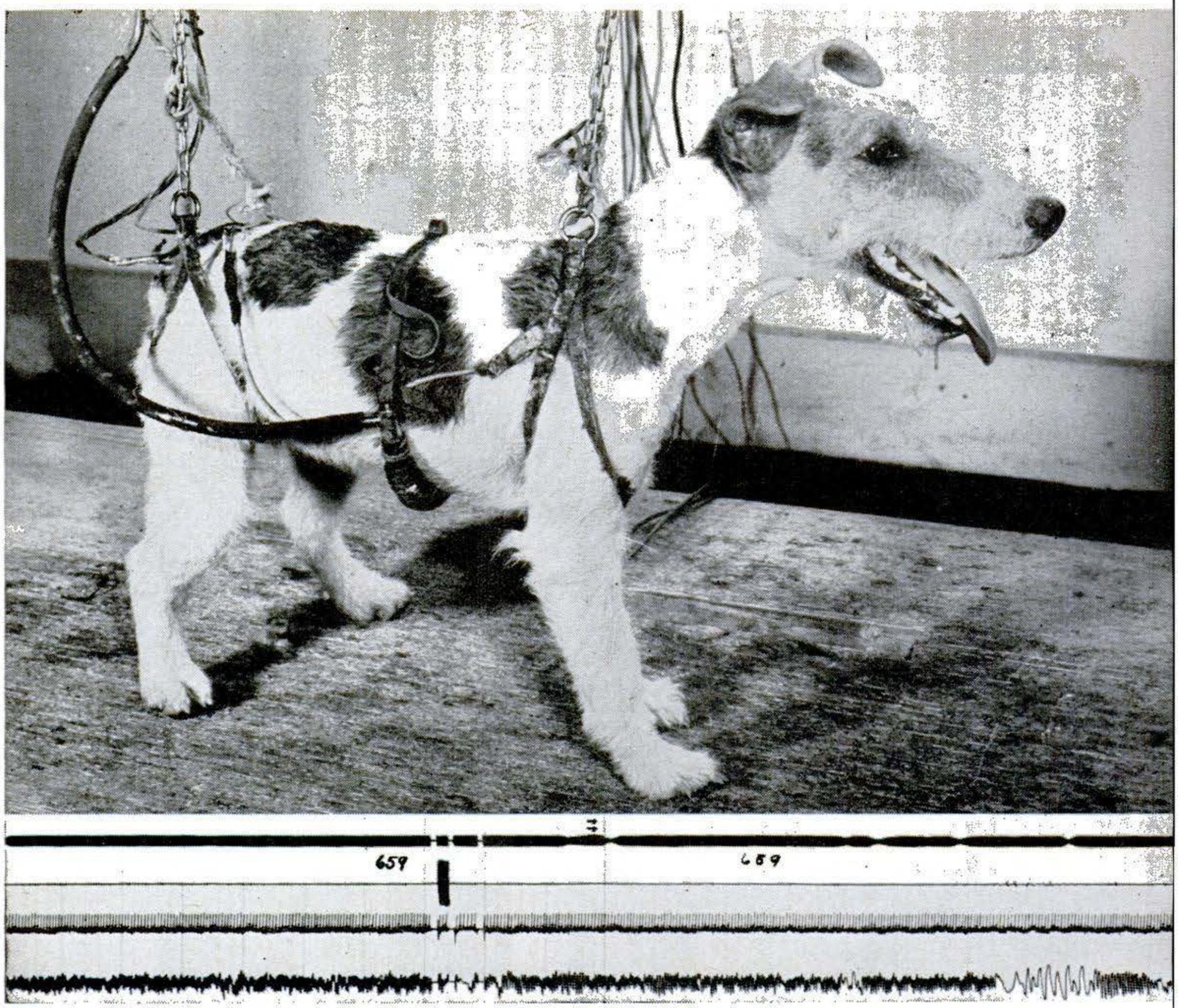

Dog No. 659, a year-old wirehaired fox terrier, wears harness wired to recording machine pictured on previous page. Graph lines below photo show her restlessness during reactivity test.

neither would she run away when the other puppies ganged up on her or when human beings entered the room.

"A well-balanced dog," Dr. Scott says of her, and he thinks that's why the black cocker did so well in the memory exam, officially known as the delayed-response test. Here the dog is placed in a pen facing two closed doors, one of which the observer opens and closes with a bang. After a while the dog is released and, if he pushes through the door that has been banged, gets food. Dogs that have scored high in timidity often refuse to leave the pen; those that have rated high in aggressiveness often are so eager to get going that they can remember for only a few seconds where they want to go. No. 701 remembered for one full minute which door to take; the best any other Bar Harbor dog has been able to do is 20 seconds.

The Laboratory is not yet ready to stamp these observations as scientifically proved, but they seem to contain one obvious lesson for humans. What the Bar Harbor institution calls its reactivity test may some day point to another. This test is part of the "primary school" curriculum, which begins when the dogs have reached the age of 16 weeks and been transferred to spacious runs in a sunny field. There a young biologist, Dr. J. L. Fuller, is in charge.

One of the school's problems is to learn if the differences in behavior that distinguish different breeds of dogs can be measured as scientifically as, say, their temperature. So Dr. Fuller has rigged up apparatus that lets him check a dog's outward activity against the activity of its heart, lungs, and muscles.

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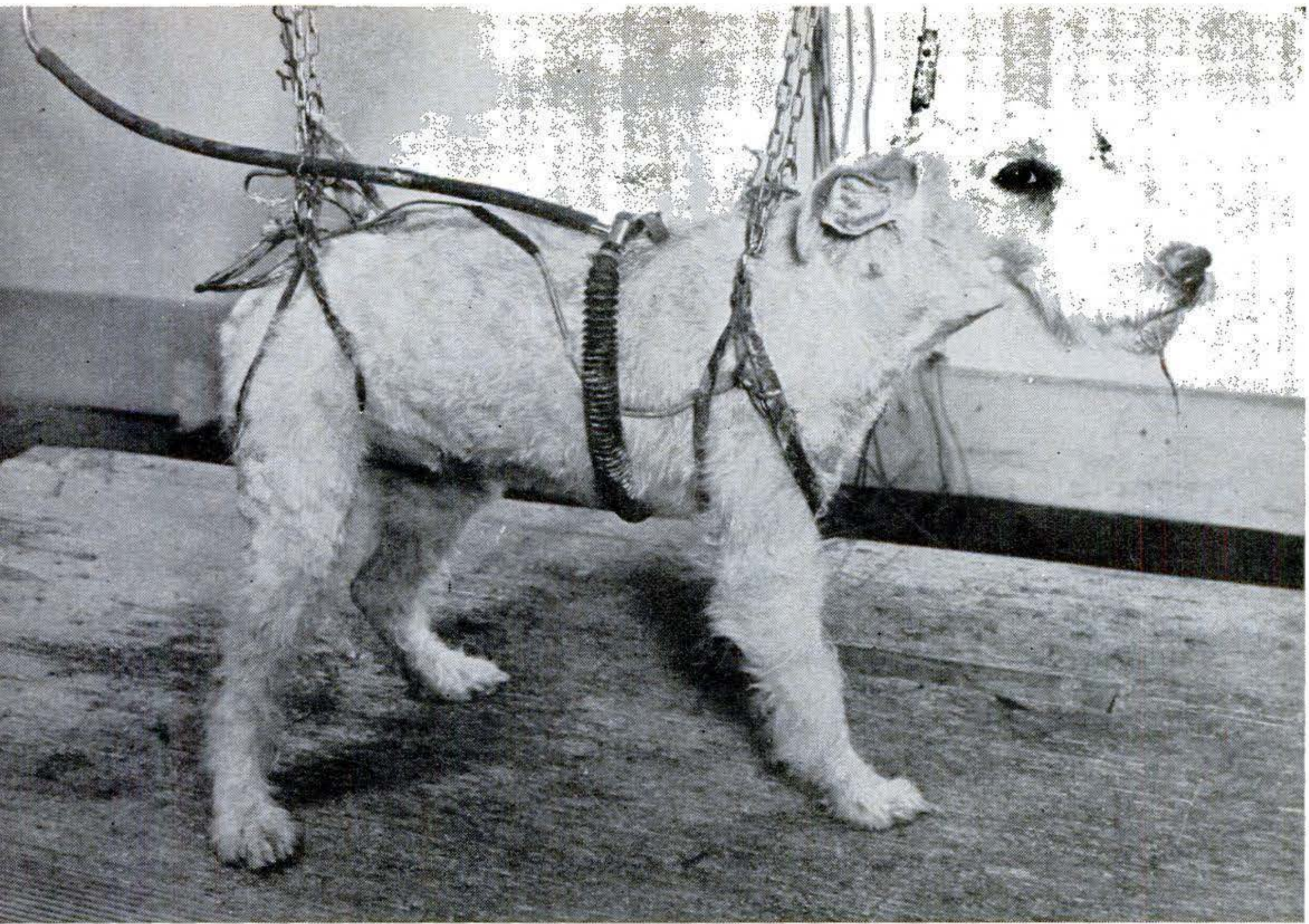

Dog No. 660, sister of the one on the opposite page, remains relatively calm—as her graphs show—in the same situations. Litter mates don't usually display such striking differences.

The experiment might strike you as odd. Here in one room is the dog; in the next, Dr. Fuller, the recording machine, and a young woman who watches through a window and notes exactly how the dog responds to changing circumstances. After the animal has been left alone a while, Dr. Fuller goes in and speaks to it gently. Then he turns off the light for a minute, and next he rings a bell. After that he yells at the dog in mock anger and brandishes a yardstick. Finally, the observer pushes a button, and the dog receives a gentle shock on the leg.

It's as if you were being initiated into a club or fraternity: you have to face situations that may frighten you but do not actually harm you.

For each period of the test, the observer grades the dog from 1 to 5, depending on his activity as shown in body movements and barking. At the end, these grades are compared with those figured from the lines on the graph. Usually the two sets correspond. Sometimes, though, a dog will be very calm outwardly but nevertheless show disturbed heart and breathing rates.

The average dog's activity is highest when he is left alone at the beginning. When first placed in the harness, he becomes restless—just like many a person being fitted for a new suit or being strapped in for his first plane ride.

His activity falls off when he is spoken to quietly, jumps up when he is left alone in the dark, and goes still higher when the bell is rung. Oddly, it reaches its low point when he is threatened—probably because he's never been punished and doesn't know that

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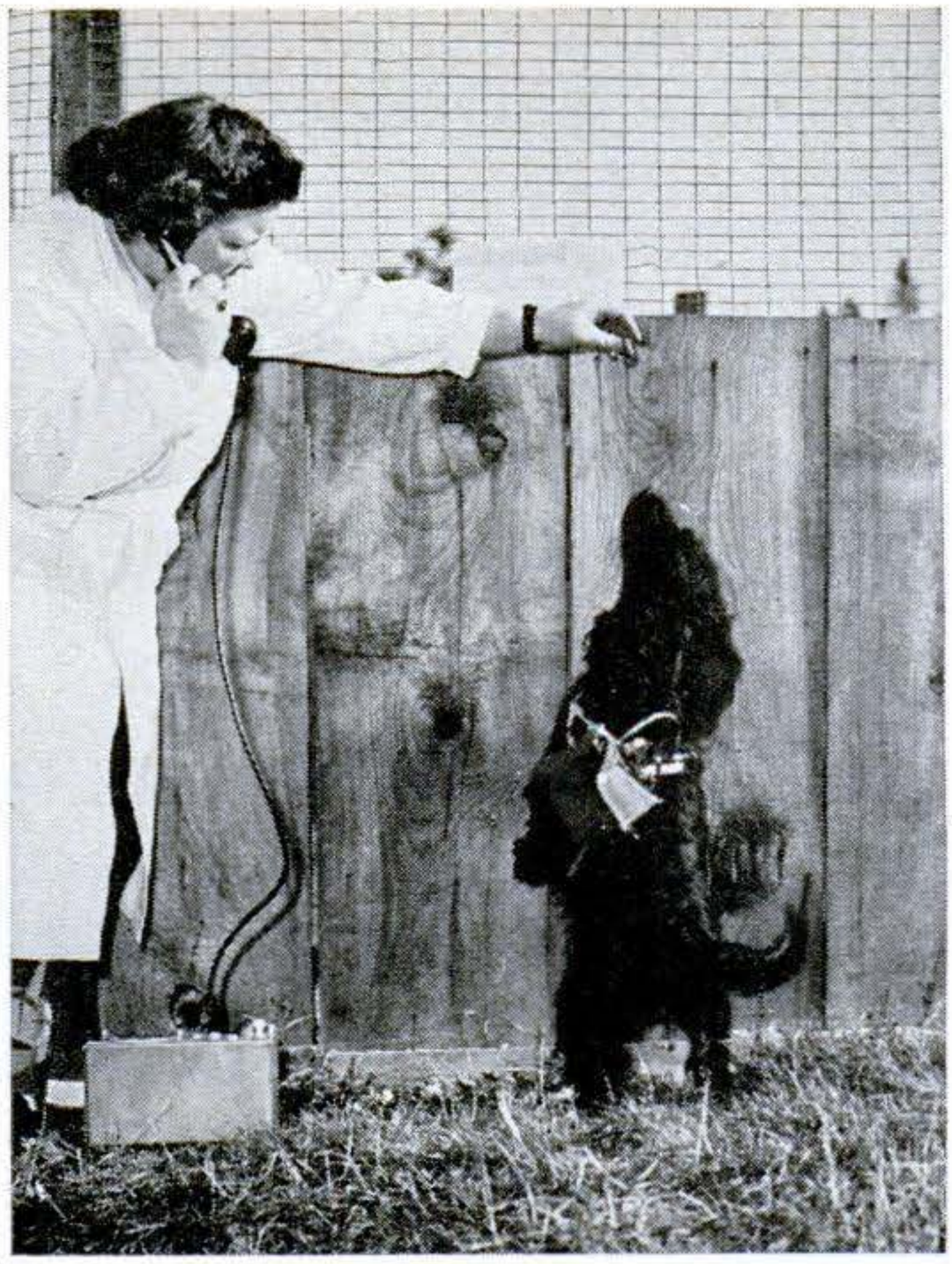
Dog "genius," No. 701, is fitted with "radio inductograph," a device that broadcasts heart or respiration rate while she runs at large.



Observer reports No. 701's behavior by telephone to a man in laboratory who is watching a graph-line report from transmitter worn by dog.

harsh words may be followed by a blow. The shock brings only a slight rise, and for many dogs has a quieting effect—the way a slight spanking often calms an unruly child.

Members of a breed act pretty much the same way—at least when first tested. Basenjis and fox terriers show the greatest activity. Then come, in order, beagles, dachshunds, and cockers. At the bottom of the list are Shetland sheep dogs, who appear timid both to the eye and to the apparatus.

From this Fuller concludes that the reactivity test—once it has been given to enough dogs—may serve to set standards for the various breeds. You can see why this would be important to scientists studying behavior. Knowing exactly how most dogs of a breed acted, they could spot out-of-the-ordinary behavior and then seek the reason for it in heredity or environment.

One drawback to the reactivity test is that it has to be given while the dog is confined. To get around this, Dr. Fuller and a New York engineer, T. M. Gordon, Jr., have devised what they call a "radio inductograph." This is a sort of walkie-talkie that broadcasts directly from the dog, wherever he goes, what's happening inside of him.

The tiny transmitter of this device, along with the hearing-aid batteries that power it, is strapped on the dog's back. When the animal's breathing rate is to be broadcast, a small bellows over his chest is connected by rubber tubing to a diaphragm in the transmitter. Movements of a foil ring on the diaphragm alter the inductance of the transmitter's oscillator coil and frequency-modulate the radio signal. Similarly, for a radio record of his pulse, a small capsule is sealed over an artery. The broadcast is fed from the receiver into the same automatic recorder used for the indoor test.

Although the radio inductograph is just being perfected, Dr. Little believes it may prove to be one of the Laboratory's most important contributions to the study of emotions—your emotions. For instance, you can walk into a clinic today and get an electrocardiogram, which shows how your heart is behaving while you're at rest. But no one knows now just what happens to your heart when you take a crucial school or employment test, or sit in an office all day, dealing with situations some of which are pleasant and some unpleasant. The eight-ounce radio inductograph, which fits easily into a coat pocket and which you'd soon forget you were wearing, could give the answer.

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In the case of heart patients, it could conceivably point out the types of work and play that are too exciting to be safe. Doctors know that excitement, particularly when caused by anger, can be more dangerous than hard work. But what makes a man angry? The Fuller-Gordon invention could help find out.

Next on the Bar Harbor program is a series of experiments to compare the behavior of dogs raised by their own mother with that of brothers and sisters who have been turned over to a dog of another breed. Preliminary studies have turned up some odd results. Fox terrier pups, for example, were given to a Shetland sheep dog right after birth. Since the Sheltie was very peaceful and the terriers nervous and aggressive, it might have been supposed that the pups would calm down. But they romped and fought as usual; and instead of slapping them down occasionally, as the real mother would have done, the Sheltie either left them alone or joined in the fun herself. So the pups became even more aggressive than fox terriers usually are.

What May Come of It

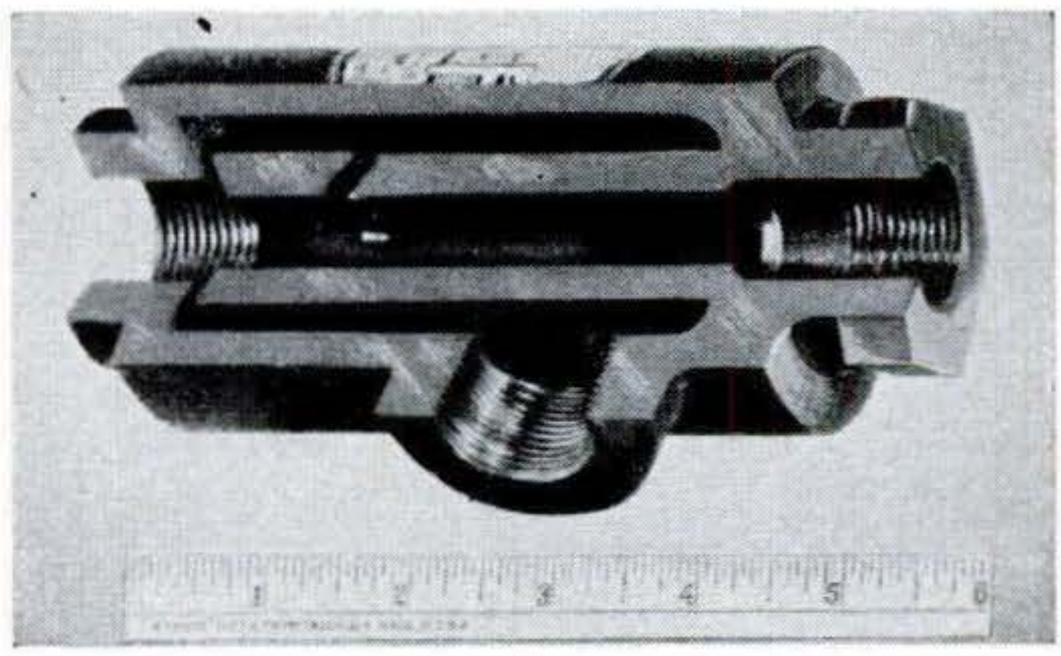
Such experiments ought to indicate which behavior traits are hereditary and which are environmental—and what you can do, for example, to make a pugnacious animal less ready to fight. Sometimes both forces are at work. For instance a dog's habit of lifting its leg at a tree, or any place else, is characteristic only of males and therefore is presumably inherited. But the average male doesn't display it until he is about five months old and he won't display it even then unless he comes into contact with a strange dog or smells where a strange dog has been.

When the Laboratory has completed the foster-mother studies, it will start cross-breeding. This will show, among other things, whether certain behavior traits, such as aggressiveness, are tied up with certain physical traits, such as rough hair; and whether or not black cockers always do better on some mental tests than red cockers or brown dachshunds or white Shelties.

Eventually the behavior division may get around to considering the cases of a couple of freaks in another part of the laboratory. One is a strain of mice; ring a bell when one of these is around and he throws a fit and dies. Another is a strain of ferocious rabbits; instead of running, they insist on fighting! END

Truck Hauls Six Blocks

THIS new hand truck, with which one man can trundle six concrete blocks at a time lightens the back-straining job of moving and stacking building blocks. Its smooth-riding pneumatic tires do away with the need for special runways and make possible the moving of "green" blocks after only one day's curing. The truck, made of heavy-gauge steel, weighs 30 pounds. Lifting forks that can be attached for a variety of jobs are available from the manufacturer, the R. S. Reed Corp., of Three Rivers, Mich.



Pipe Joint Heats Water

THIS small cast-iron pipe coupling can take the place of a large hot-water storage tank in any plant with supplies of steam and cold water. Steam, piped into the side of the cylinder, mixes with cold water entering from end—at right in cutaway above. Result is a steady, quiet flow of hot water from the other end. The Safe-Flo® comes in sizes from ¾-in. (shown) to 3-in., uses steam at pressures of 10 to 1,000 lb.

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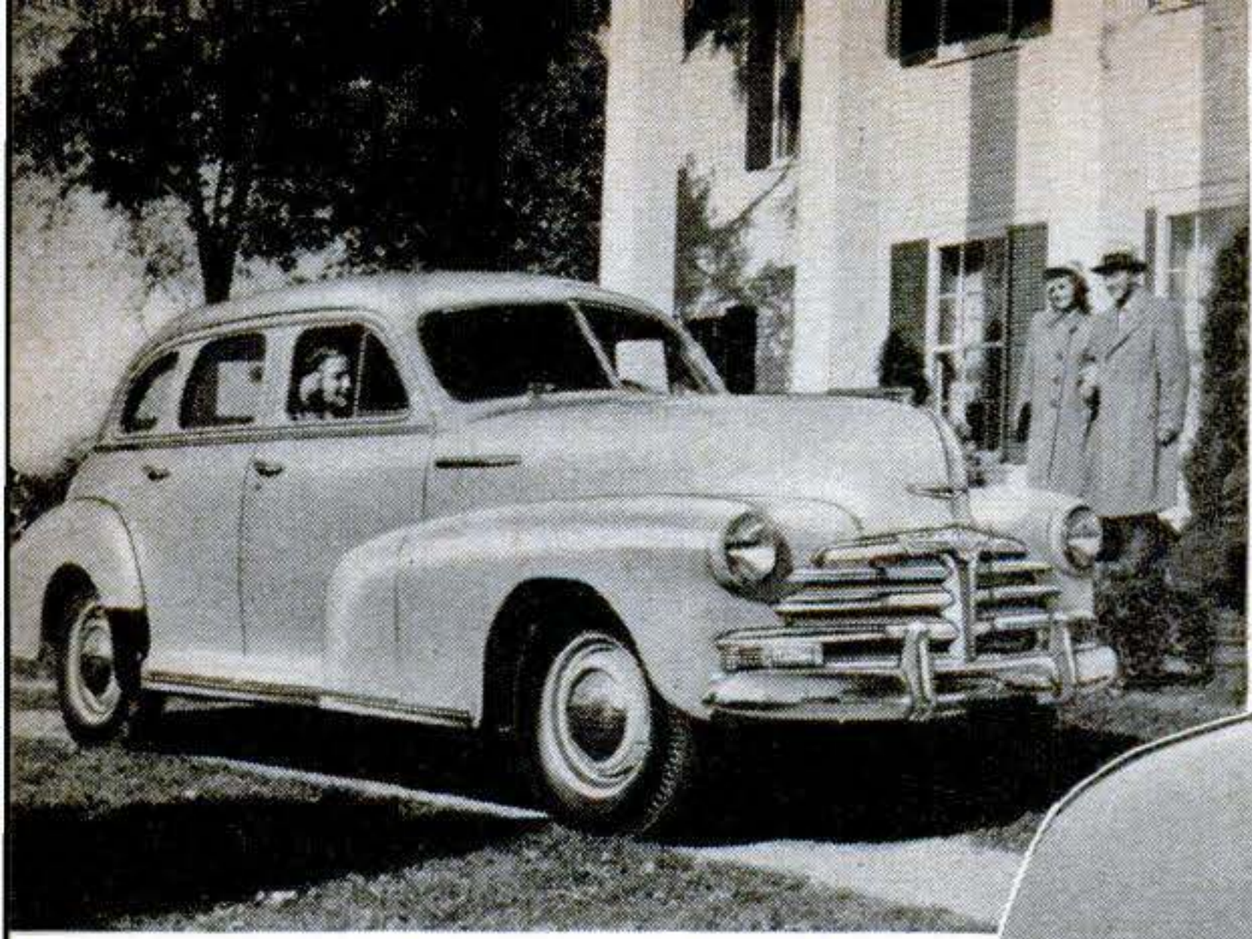

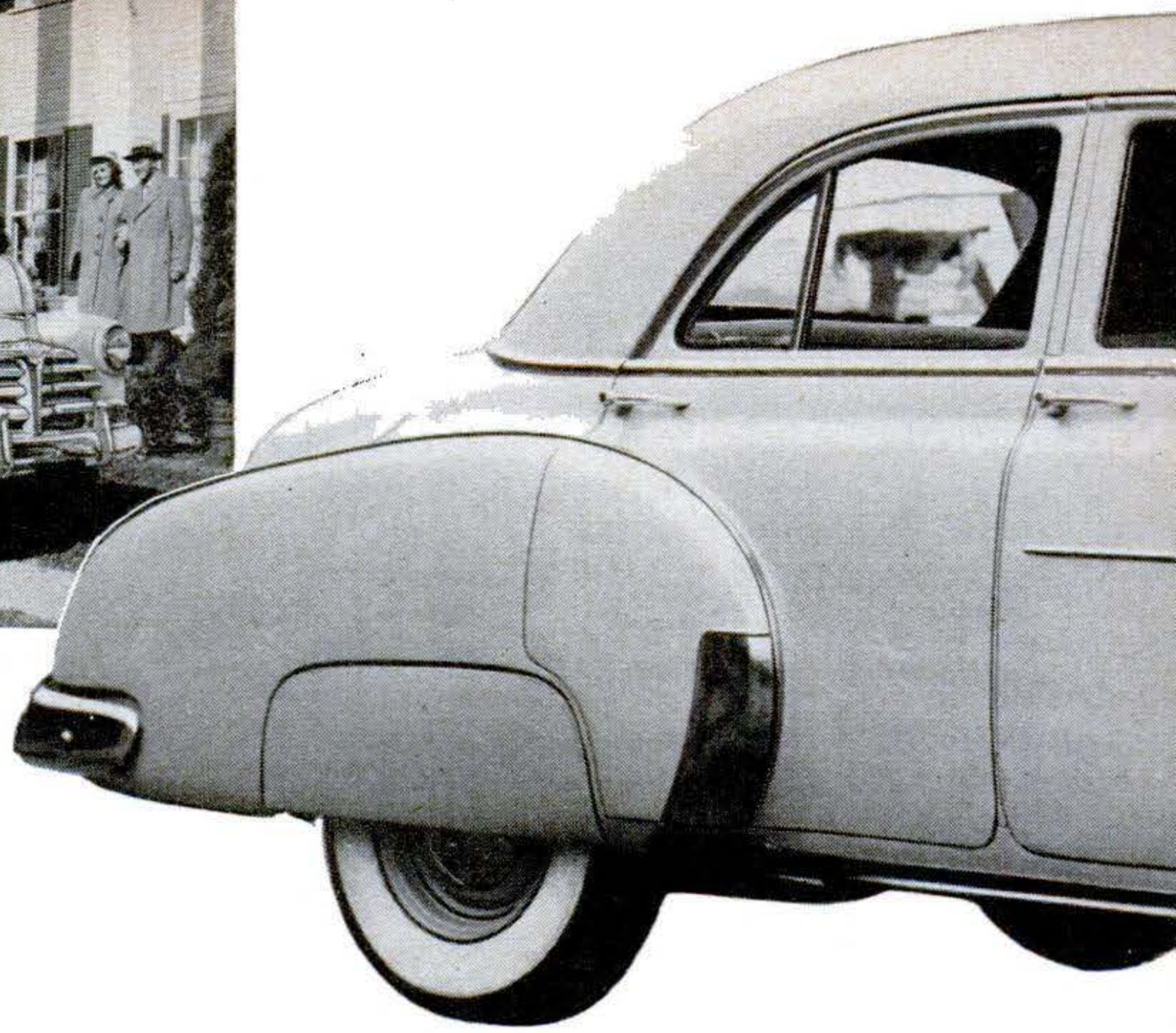

Body of '49 Chevy (right) is filled out to take in front fenders that helped identify '48 model (above). Partial rear fenders remain as a GM family trait. Four-door sedan has 440 square inches more glass area than last year's.

New Chevrolet Styled for Looks—and Easy Upkeep

THE first Chevrolets with the postwar look, introduced to the public late last month, answer a question that has been bedeviling motorists ever since car bodies began swelling out to absorb the fenders—and collect expensive collision dents.

The question: What can the manufacturers do to reduce owners' repair bills on drum-tight automobile skins in which a dented fender means a body job? Chevrolet's answer is to make the car's skin easier to get at *from the inside.*

In the '49 Chevies, dents in the rear can be bumped out from the trunk compartment. Farther ahead, the skin can be reached by removing the seat cushions and, in some cases, the interior trim. And a repairman can get at the inside of the rear fenders from underneath by unbolting access doors opposite the wheel housings.

This feature of the body design is just part of a complete restyling that leaves little of the 1948 Chevrolets in those for '49. Only the six-cylinder, valve-in-head engine remains basically unchanged.

The new models are lighter, lower, wider. Wheelbase and over-all length have been shaved a trifle. The engine has been moved four inches forward to let passengers in the back seat ride ahead of the wheels.

Curved windshields, thinner posts, and wider, deeper windows improve the driver's visibility. He can see the road 11 feet closer to the front of the car, and 24 feet closer to the rear, than in '48 models.

The new cars come in two series. Fleetline® models have the "fast back," with the sweep of the roof unbroken to the rear. In the notch-back Styleline®, the roof meets the rear deck at the body belt line.

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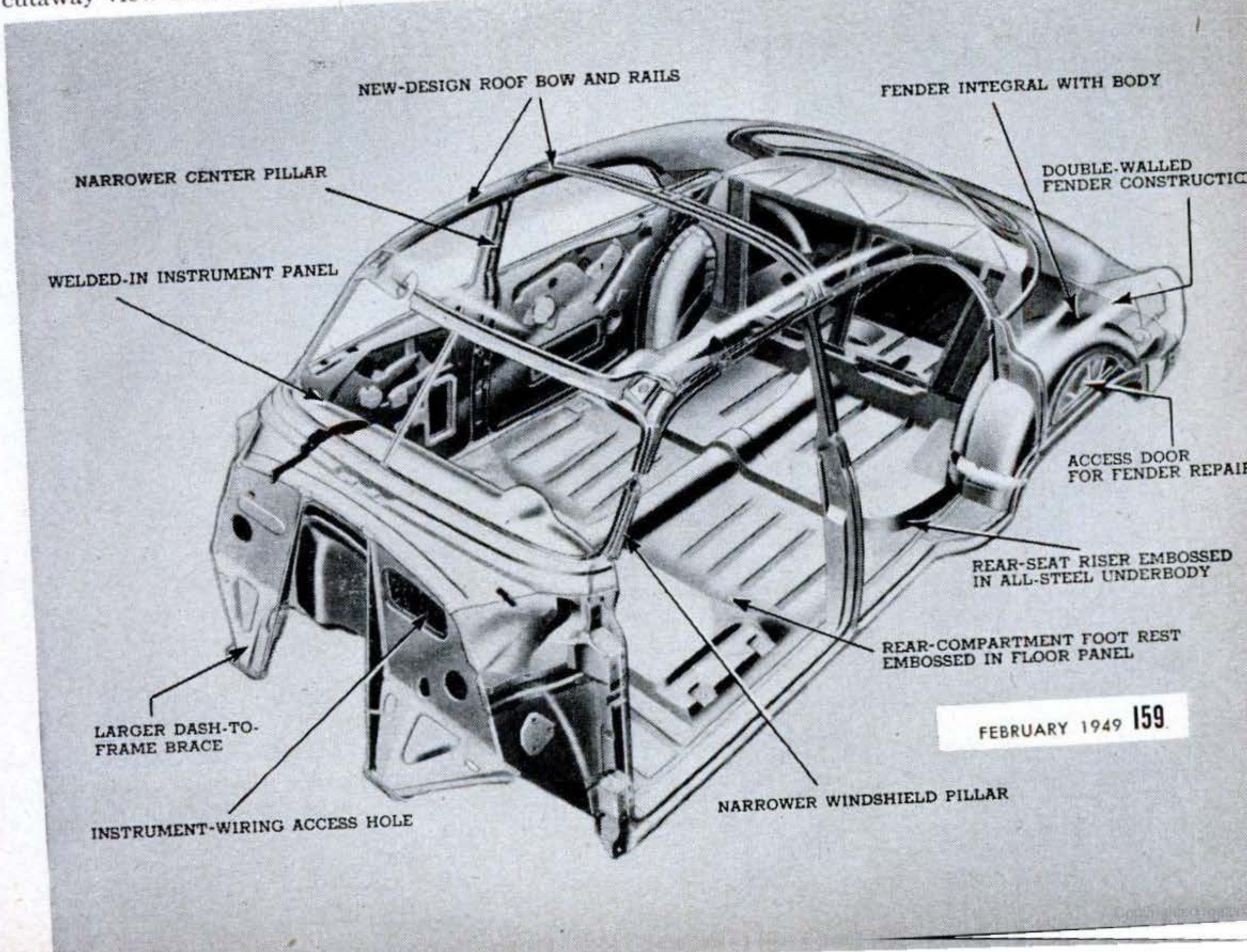
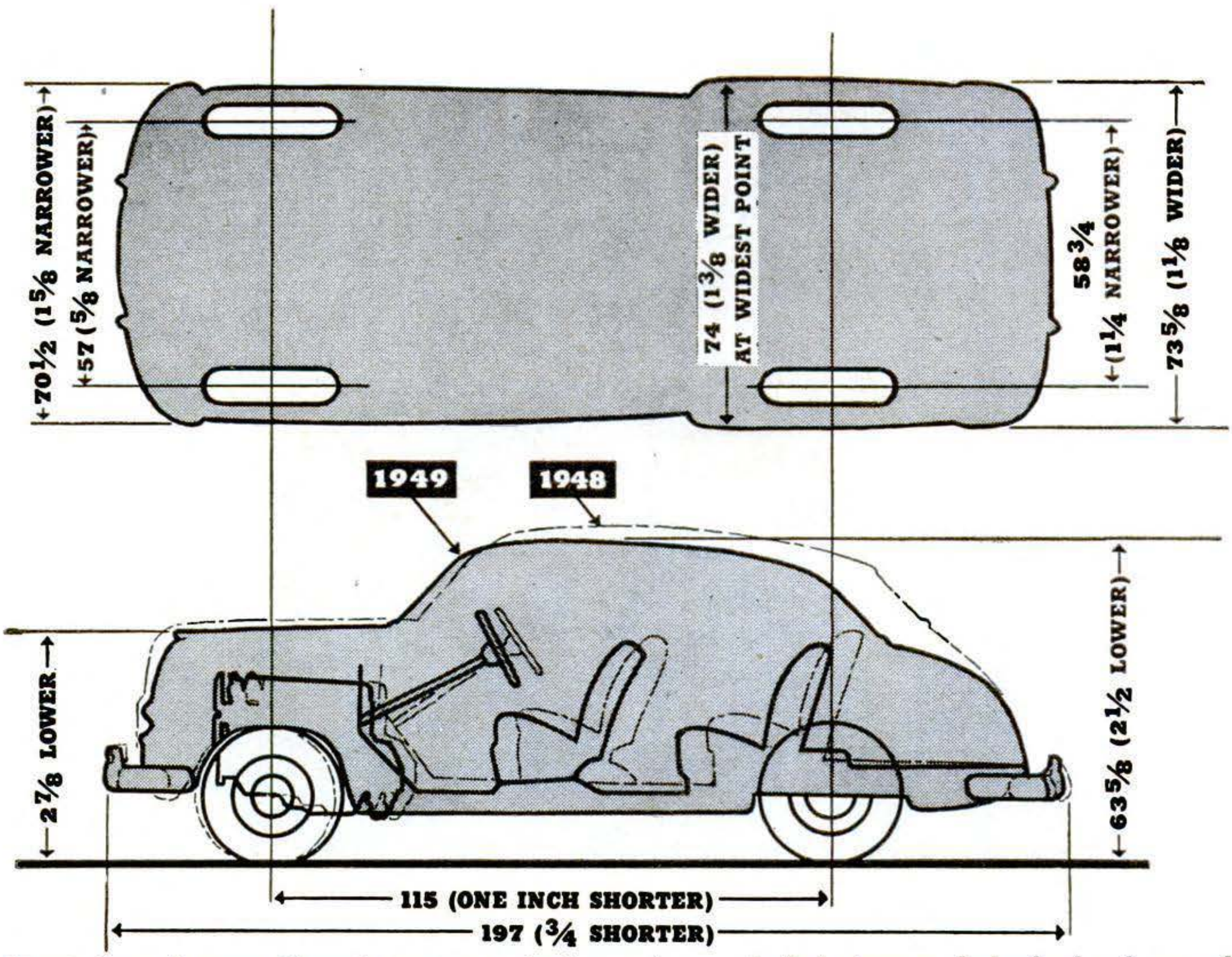
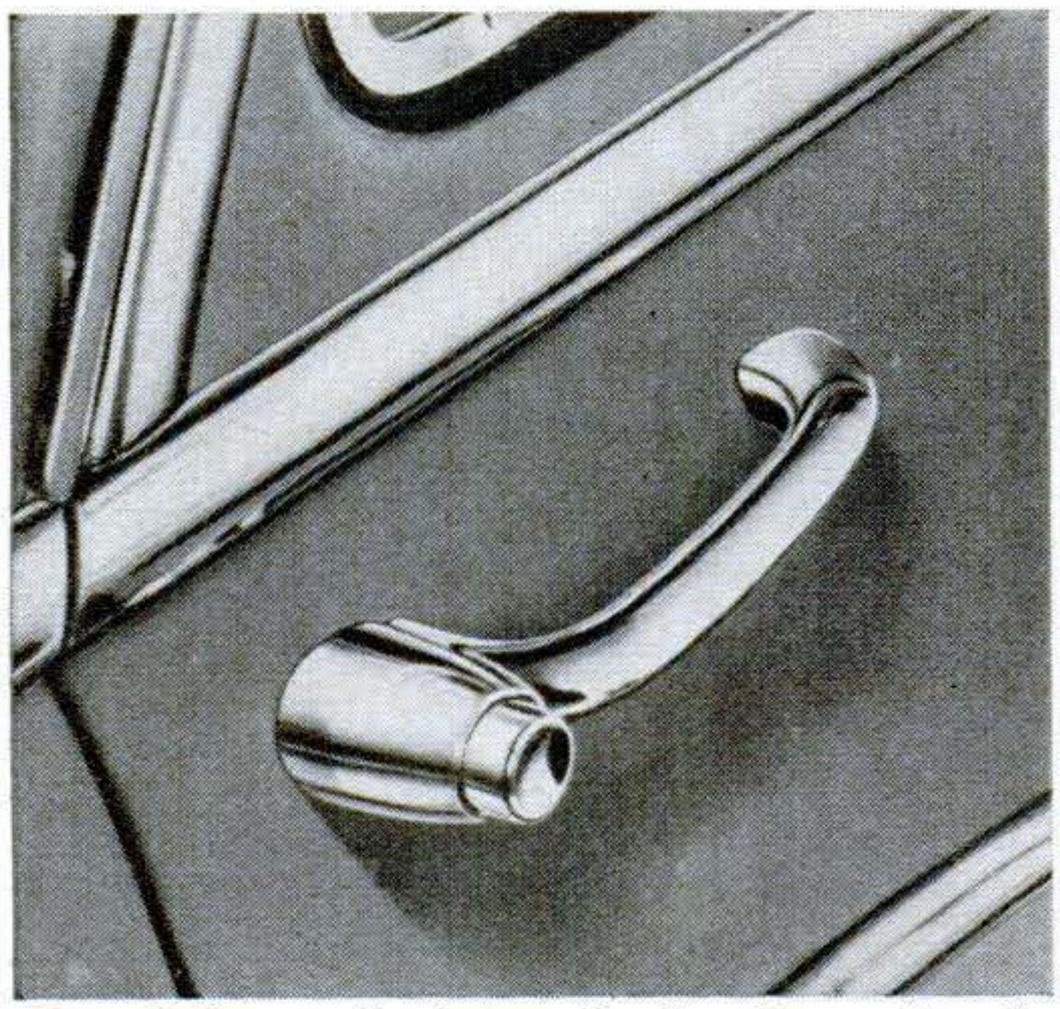
Frame is lighter, yet stronger and stiffer. This cutaway view of the new design (below) shows access door that lets repairman get at inside of rear fender to bump out a dent.

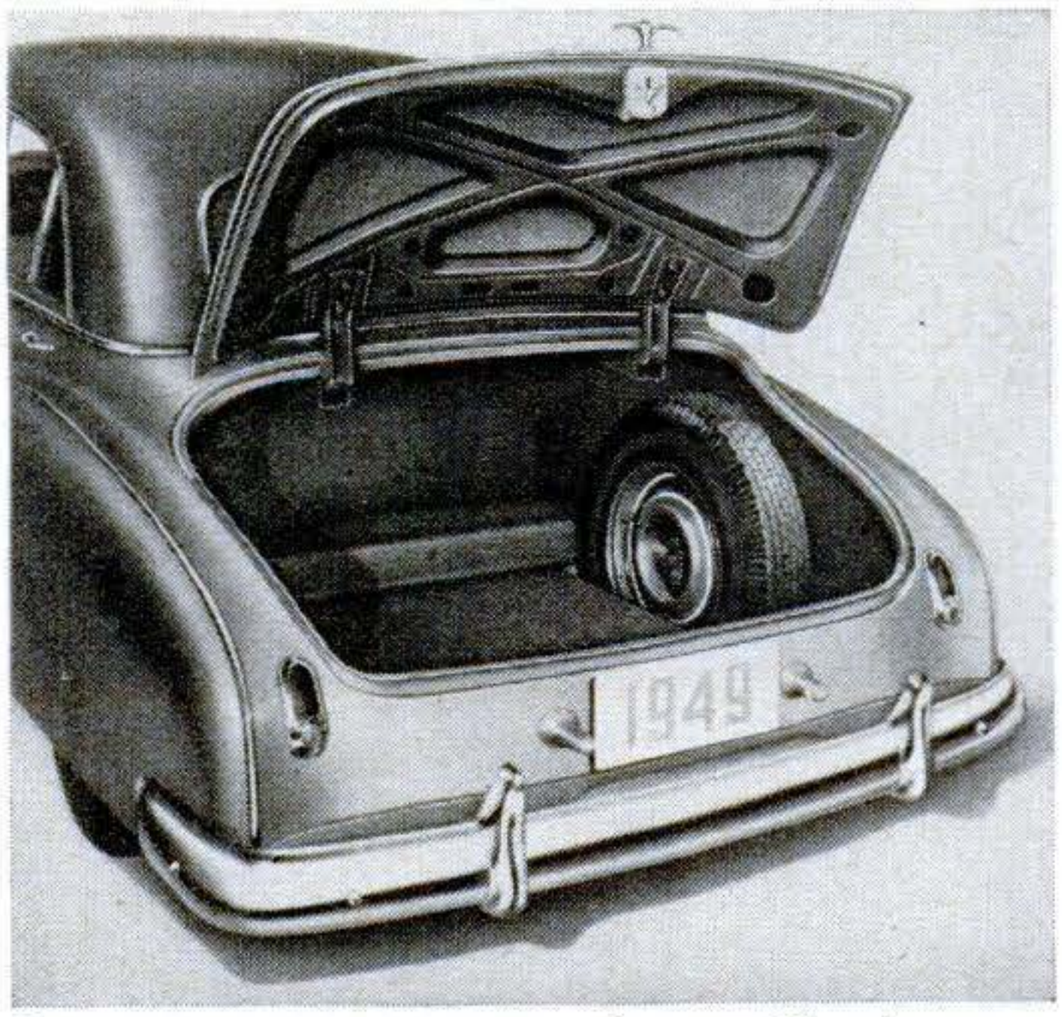




Here's how the new Chevrolets compare in size and layout with last year's. Dimensions shown are in inches. Ground clearance is 7½ in. under the muffler, an increase of ¼ in. Mechanical changes include improved shock absorbers and a center-based steering system that equalizes the effects of road shocks and gives greater symmetry of front-wheel movement.



Thumb button built into fixed pull-type handle opens doors from outside. Interior hardware is shaped close to doors to avoid snagging garments. Instrument-panel controls are grouped in front of driver, except knobs that regulate ventilation. New air-conditioning system eliminates cowl vent and draws air through ducts between front fender skirts and the radiator.



Luggage compartment of new Chevies contains 20 percent more space than in last year's models. Spring-loaded catch locks automatically when lid is dropped. Bumpers, recessed into body, wrap far around to protect fenders. A spring clamp in the trunk keeps the car jack from rattling around. Gas tank, shifted to the left, has inlet under a lid built into rear fender.

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Why pilot gets hot: Ram temperature, caused by friction of wings and fuselage against air, rises rapidly with speed. Sun's radiant heat pours through transparent canopy. Then there's also heat from his body, from the plane's electrical and hydraulic equipment, and from its engine.

Speed's New Foe: The 'Heat Barrier'

Researchers seek ways to keep "ram temperature" in supersonic flight from melting planes and cooking pilots.

By Andrew R. Boone

Drawings by Ray Pioch

NOW that jet power and airplane streamlining have cracked the "sonic barrier," aeronautical scientists are tackling an even tougher foe: the heat barrier.

You've seen what that can do to a flying object if you ever watched a meteor flaming through the night sky. What made the meteor flame into vapor was its friction against the air when it dived into the earth's atmosphere from outer space at 20 miles a second.

In an airplane flying not much faster than today's jets—and only 1/100 as fast as a meteor—that same kind of friction could melt the plastic canopy, burn out the controls, and broil the pilot.

Airmen call this friction heat *ram temperature*. It's caused when any solid object rams into air hard enough to compress its molecules against one another.

Reciprocating-engine planes don't go fast enough to make this a problem. But in jets, ram heat shoots up high enough to require cockpit refrigeration. The skin of a jet fighter doing 650 m.p.h. near sea level on a hot day gets up to 170° F. Other sources of heat—the sun's rays, the pilot's body temperature, and the plane's electrical equipment and power plant—would bring the cockpit up to 200° but for its refrigerating system.

How to handle ram temperature in ramjet planes (PS, Jan. '49, p. 130) and in rocket

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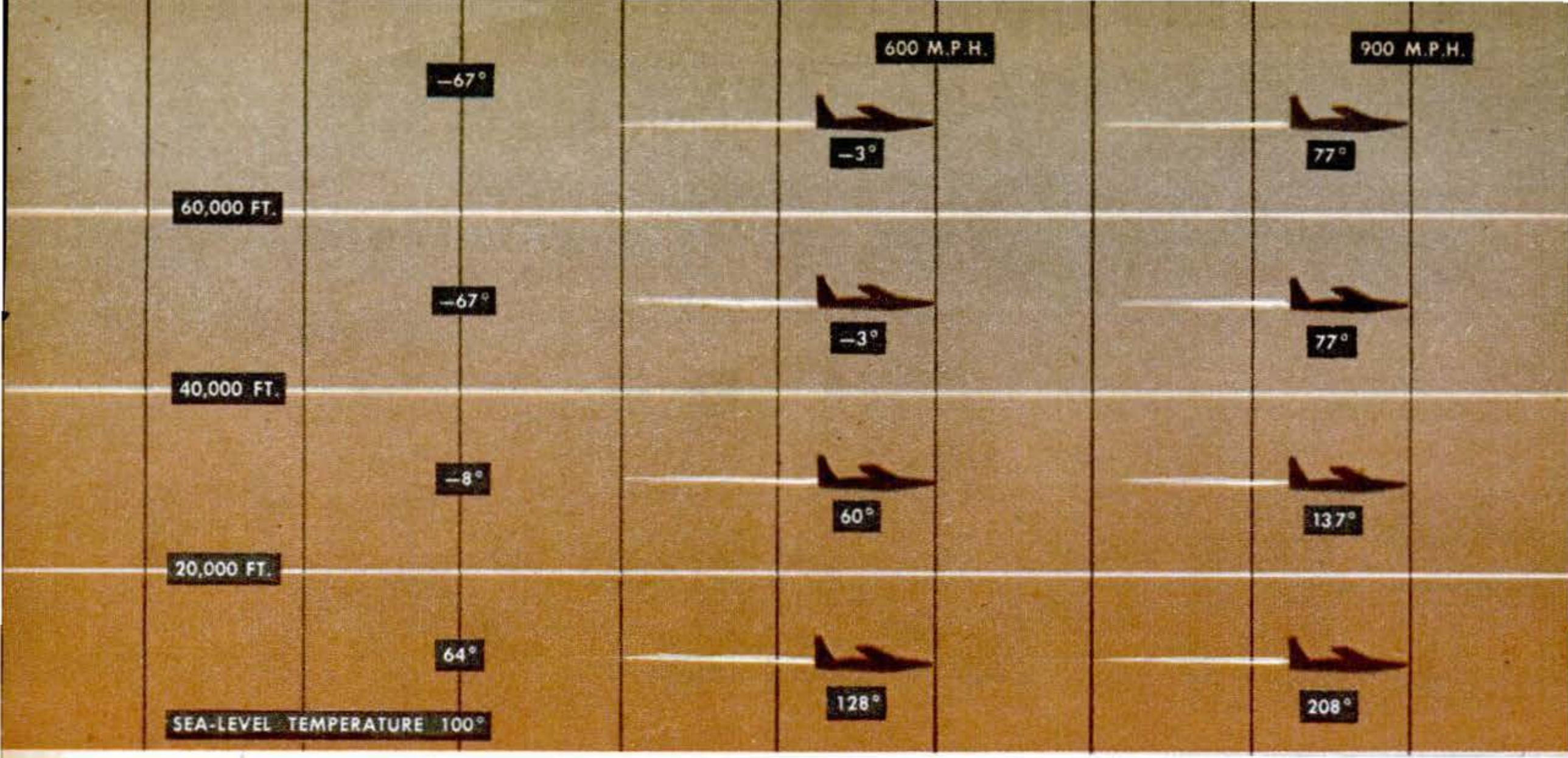


Air temperatures in Fahrenheit are shown at left on chart, ram temperature under each plane.

ships—skin temperatures as high as 1,500° F. have been recorded in V-2s—has become a top-priority research program.

This research looks in three directions: finding out how much heat the human body can stand (PS, March '48, p. 130); improving cockpit refrigerators (PS, March '48, p. 110); and seeking better materials for airplane skins and other parts that will stand the soaring temperatures of supersonic flight.

Results so far are hopeful.

Experimenters at the University of California have found that the human body can —for a short time—take temperatures that would cook meat and boil coffee. If a man can live in that heat, maybe ways can be found for him to work and think straight in it.

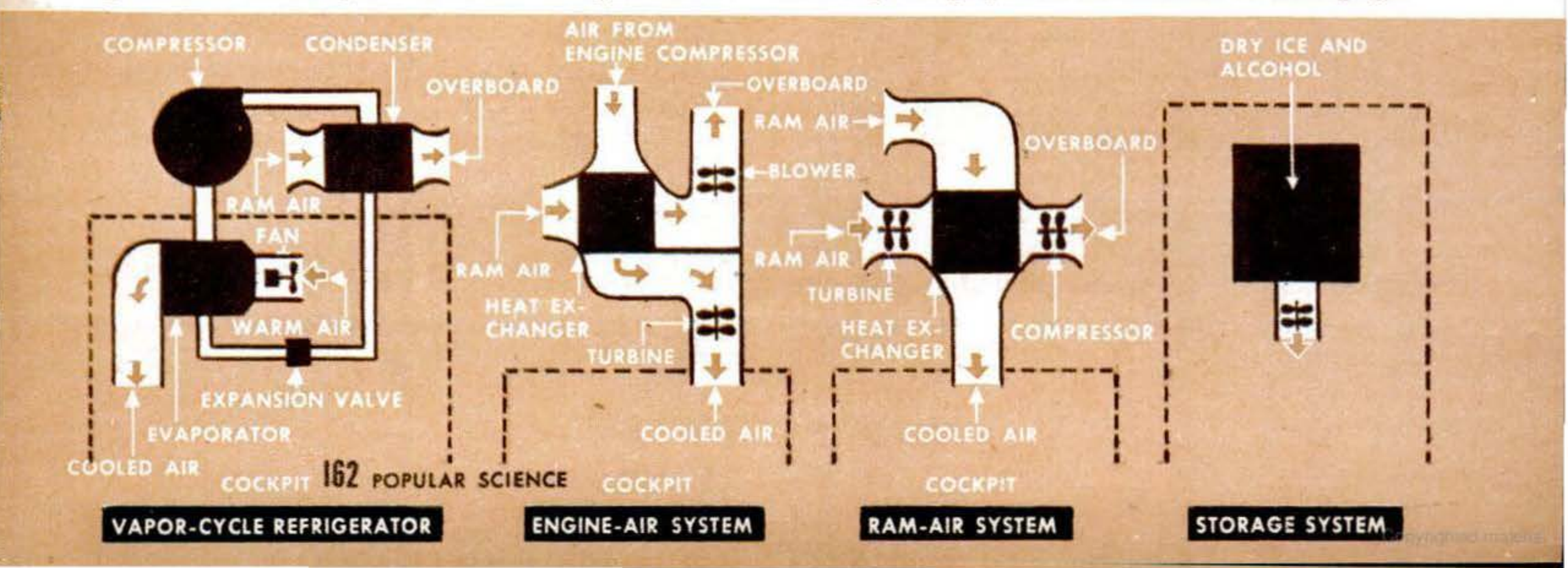
Refrigeration engineers say they have developed coolers that would keep a cockpit livable at 2,500 m.p.h. Some of these cleverly use ram and engine heat to offset their own effects. The latest is merely a refinement of the old-fashioned icebox. When a better one is needed, the engineers count on the cooling effect from evaporation of liquid oxygen, which boils at −297.4° F.

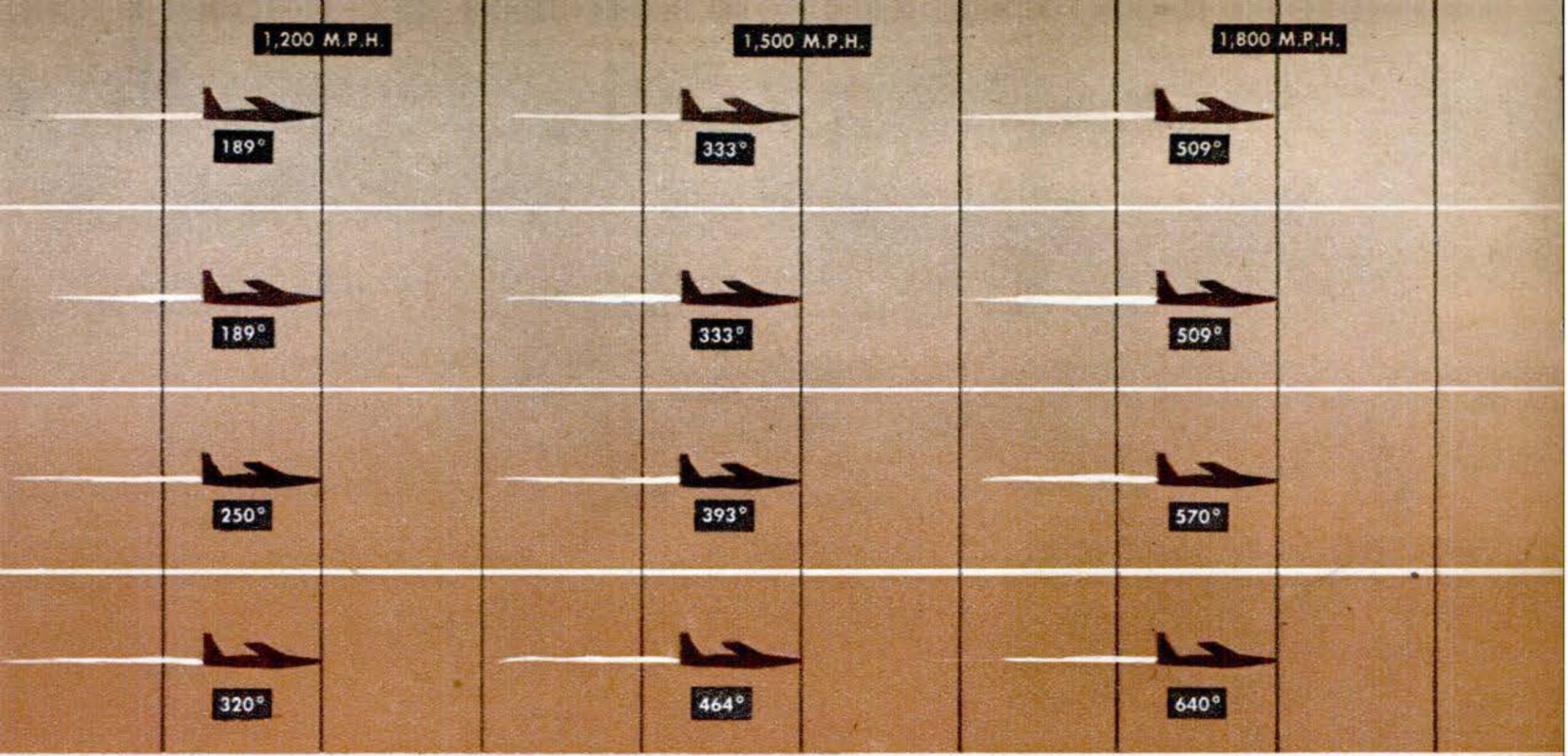
And metallurgists figure that a stainless-steel plane could clip off 2,800 m.p.h. at sea level—more higher up—without wilting. A plane of titanium (PS, Dec. '48, p. 105) might be even better.

Luckily, the fact that supersonic planes will fly high will help to keep them from burning up. For one thing, the air is cooler up there: −67° F. between 7½ and 25 miles above the earth when it's 100° just off the ground.

More important, air density decreases with altitude. And the lighter the air, the less its friction against a plane flying through it. At 100 miles up the molecules are more than 30 feet apart, and ram compression is negligi-

Cockpit coolers are shown below in order of efficiency. First, at left, uses outside air to carry heat from refrigerator in reciprocating-engine planes. In next, expansion of ram-compressed air helps cool expanding air from compressor of gas-turbine engine. Third cools ram air with ram air. The fourth, good up to 2,500 m.p.h., is described in the photographs at the bottom of next page.





In thin air of same temperature at 50,000 and 70,000 feet, ram heat varies only with speed.

ble. It will remain a problem, though, at any altitudes airplanes are likely to attain in the next few years.

And where ram temperature leaves off another heat problem takes over. This is the increased heat from the sun. It works two ways, heating both the atmosphere and any exposed surface.

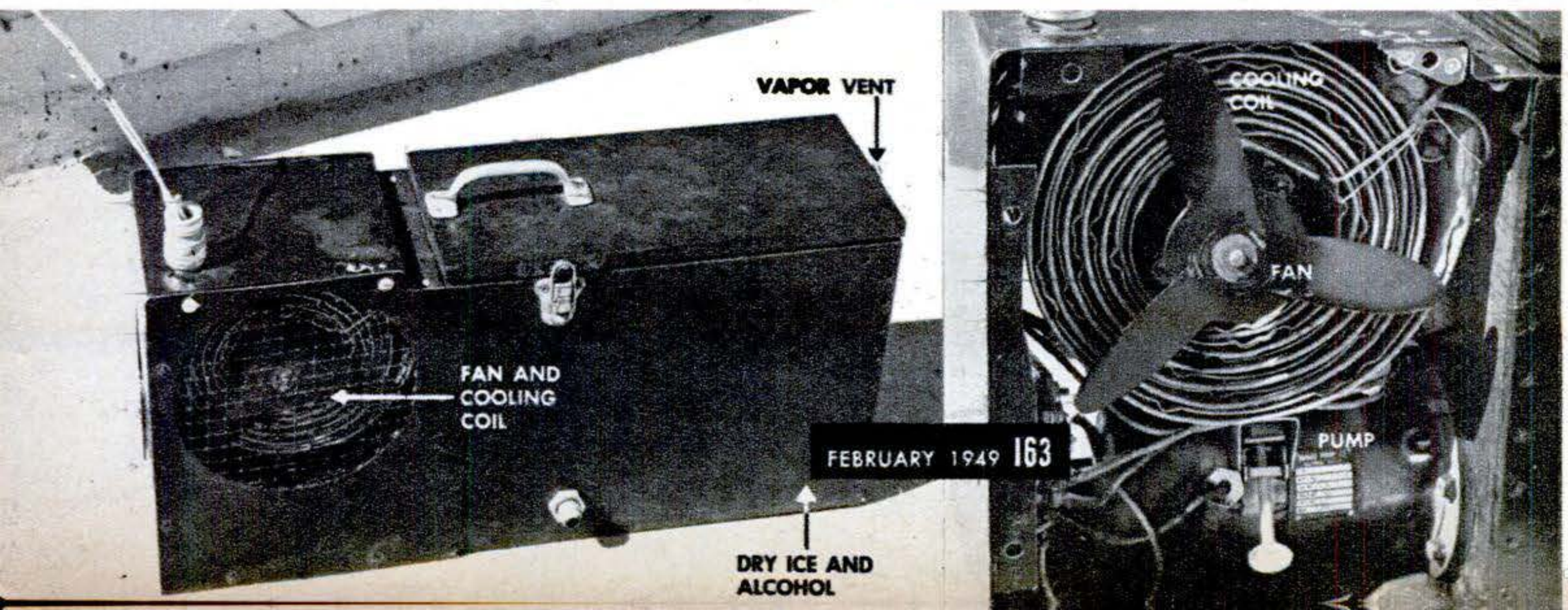
Above 25 miles, atmospheric temperature reverses its direction. From there, it rises irregularly like a fever chart. At 75 miles it reaches 215° F. And any object up there is also heated by direct radiation from the sun. Just outside the earth's atmosphere—about 200 miles up—the sun's radiant heat alone would warm a house on the coldest day. There's nothing much up there to block either its rays or cosmic-ray particles.

Add radiant heat, plus the extreme outdoor temperature, to the terrific combustion heat from a rocket engine strong enough to push a space ship to the edge of the atmosphere; then substract the cooling effect from expansion of the engine's liquid fuel into gas —and you have a good-sized problem in cabin air-conditioning.

You also have the makings of a solution. Precise controls might balance the heating and cooling. Maybe it would help to give the steel surface of your space ship a high polish on one side and a coating of dull black paint on the other. The polished surface would reflect off 85 percent of the sun's radiant heat, while the black surface would soak it in. You could then partly air-condition your ship, heating it or not as needed, by rolling it over in flight.

Or perhaps you would avoid the sun's heat by flying only at night. You'd have to be careful, then, not to whizz around the world from night into day—and smack into the heat barrier. END

Icebox-type cooler (below), used in Douglas Skystreak jet fighter, looks like small suitcase. It contains 25 lb. of dry ice immersed in a gallon of alcohol. Chilled alcohol is pumped through coil of flat tubing (right) to cool cockpit air blown over the tubes by a fan. The box is placed in a compartment behind pilot, and vapors escape outside the plane through an overflow pipe.



Microfilm camera is completely automatic. Attendant need only start copy feeding in straight. Inset, left, shows feed mechanism with cover off. Endless belts pick up copy, carry it past exposure slit, and then eject it, at either front or back of compact, console-size cabinet as desired. Previous cameras could copy only limited lengths, required cumbersome and unsteady equipment.

Camera Makes Half-Mile Copies At a Gulp

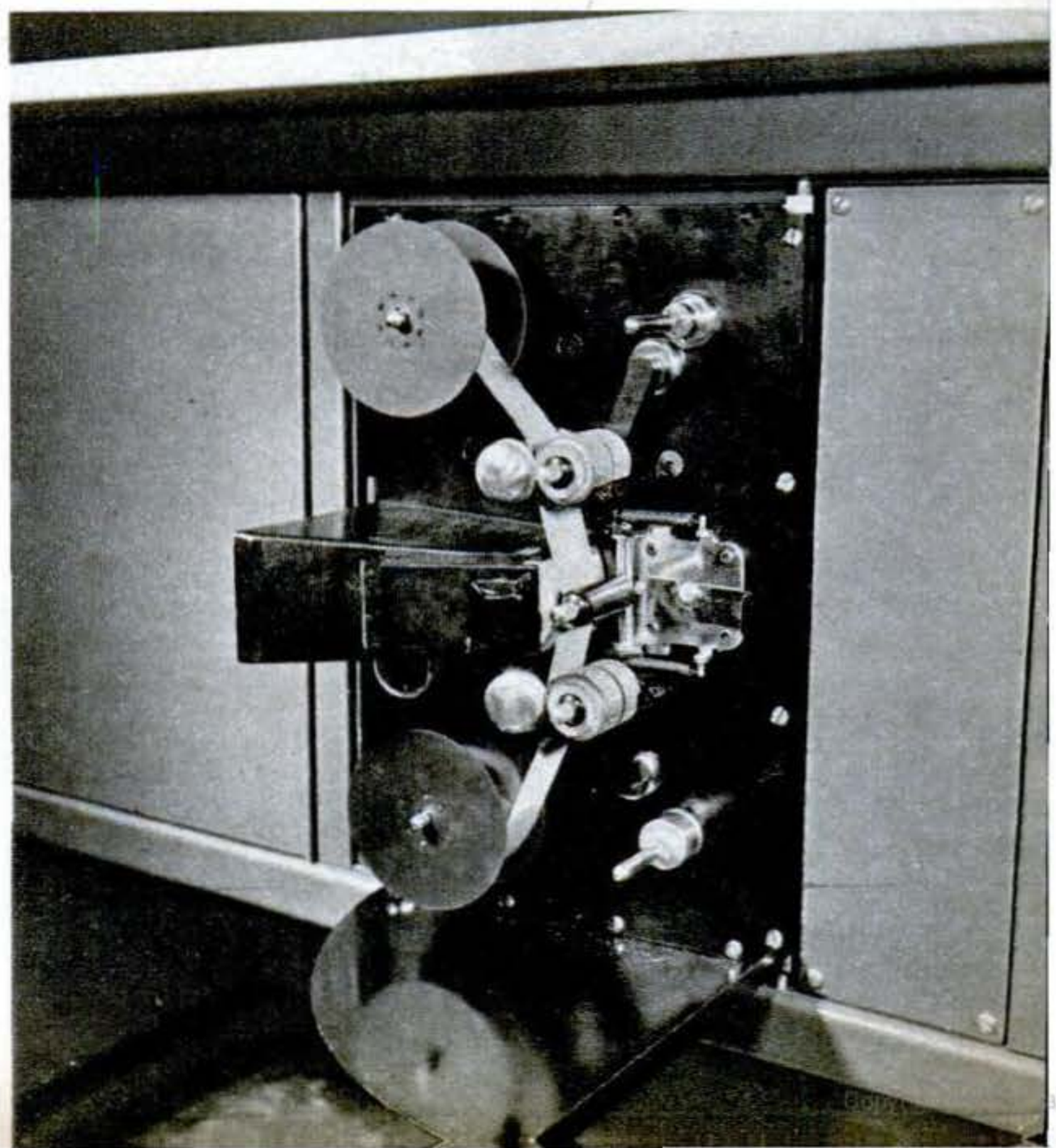
PS photos by Hubert Luckett

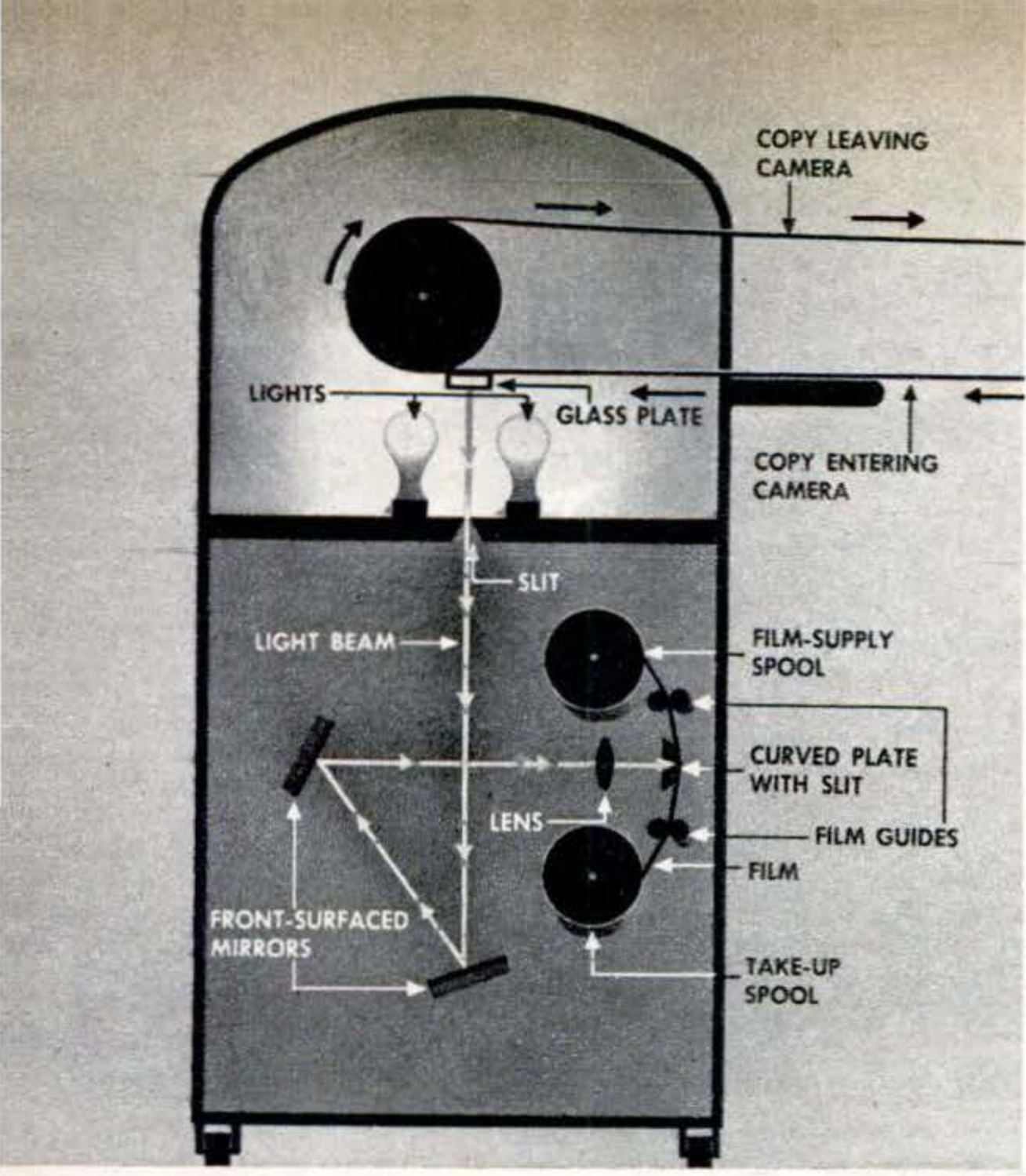
MAPS, charts, and other large documents up to 42 inches wide and ⅝ of a mile long can be quickly copied on 35-mm. film with this new Flofilm® microfilm camera.

It doesn't snap the whole 3,300 feet at one time. Instead, it records the original document a little at a time as it moves rapidly past a narrow slit. To do this, the film is moved at exactly the same speed as the copy, and the image is "flowed" onto the inch-wide negative in one continuous operation.

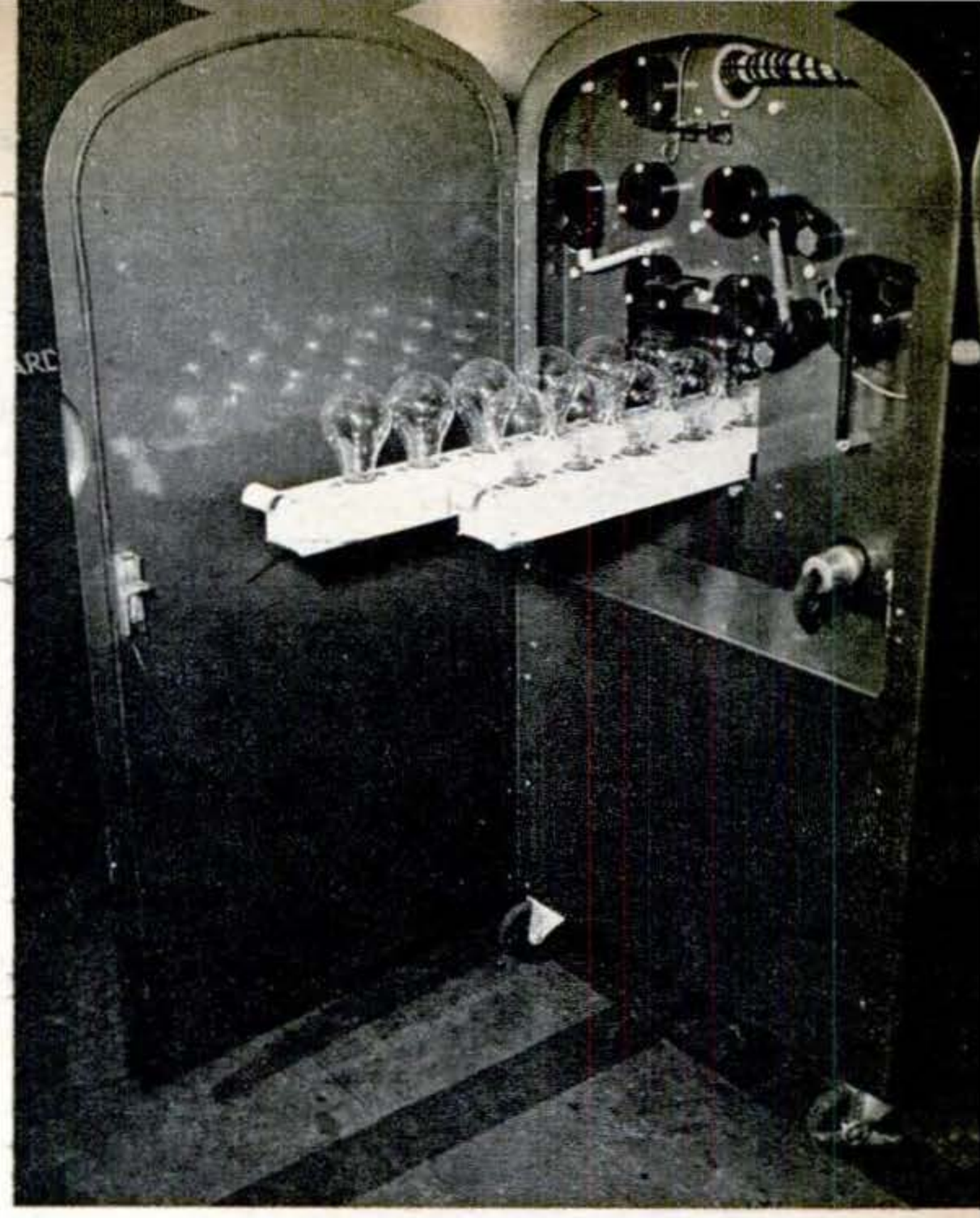
Of course there aren't many five-furlong charts to copy. Main advantage is that the machine can copy a large document or many small ones at 60 feet a minute. Reversed, it becomes an enlarger or contact printer.

For easy accessibility, lens and film-transport assembly swings out from behind center door in lower part of cabinet. Film moves past slit behind lens at speed exactly equal to that of copy. This eliminates need for shutter. Copy and film transports are driven by hysteresis-type synchronous motors to insure identical speeds. Upper reel is film-supply spool; lower one, take-up spool.





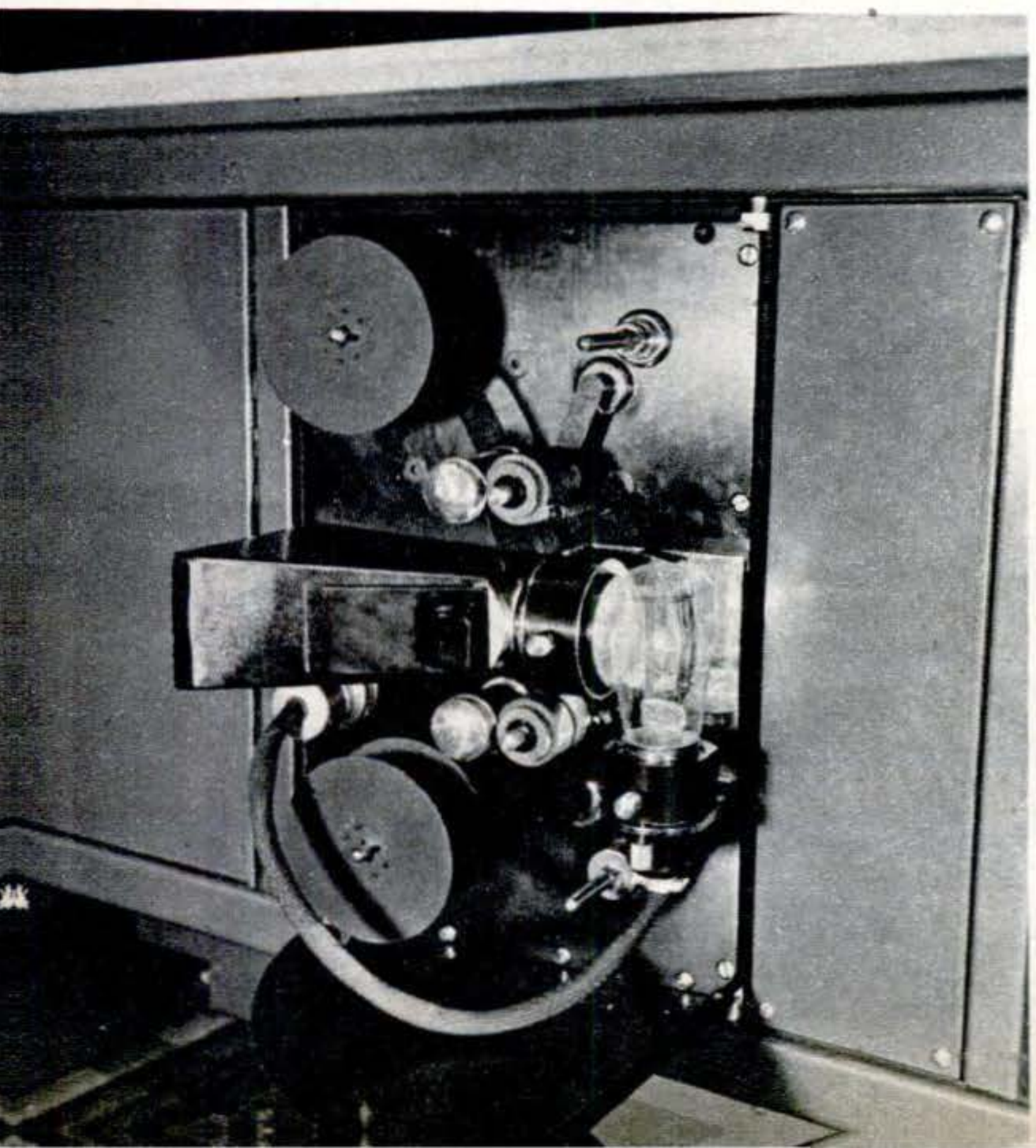
Camera's compactness is shown in drawing above. To save space and still keep distance between copy and film, light beam is bounced from one angled mirror to another, like baseball players tossing ball around infield. This also increases rigidity and results in clearer image since actual distance is small. In enlarging, beam travels same path, but in the opposite direction.

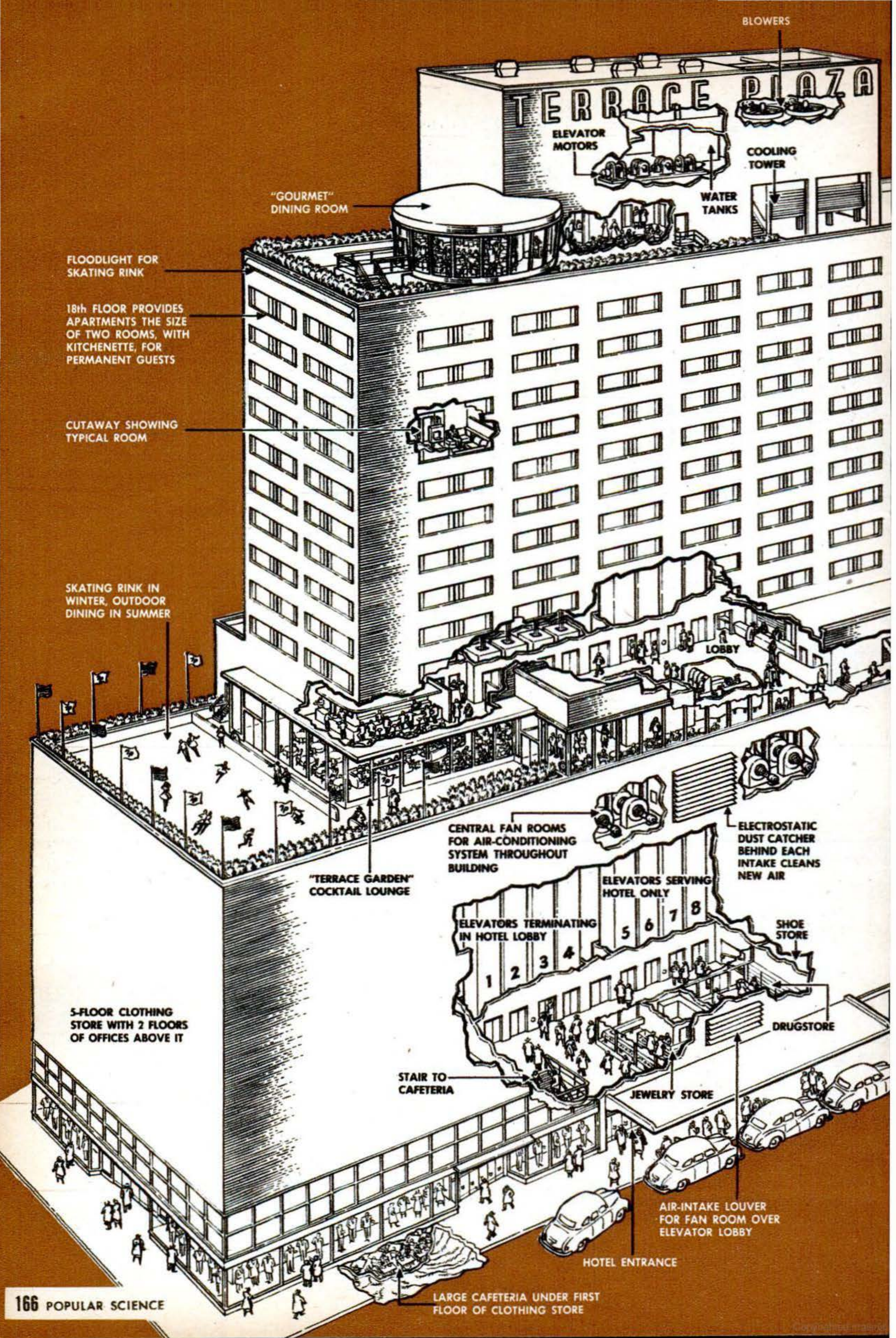


Copy is illuminated by two banks of lights, one on each side of exposure slit. Racks contain standard light bulbs and can be easily slid out, like ice trays, for replacement of burned-out bulbs. As copy passes exposure slit, feed belts press it against a glass plate, shown in the drawing at left, to hold it smooth and flat. The same lens is used both for photographing and enlarging.

Camera becomes an enlarger by simply replacing the unexposed film with a developed negative and putting a light source behind it. Now the whole process is reversed. Sensitized paper is fed into machine at the top in place of copy, and the microfilm record is printed on it full size. The light source, seen in position to the right of the lens, is a high-intensity zirconium-arc lamp.

Another adjustment, and camera becomes a contact printer. Here unexposed film is added to developed negative, and two are held tight together by pressure roller. A small exposure light replaces the lens. As film and negative move past slit, a continuous contact print is made. Here, camera's lens is held in attendant's right hand; zirconium-arc lamp and exposure light are in left.




BLOWERS
TERRACE PLAZA
ELEVATOR MOTORS
COOLING TOWER
WATER TANKS
"GOURMET" DINING ROOM
FLOODLIGHT FOR SKATING RINK
18th FLOOR PROVIDES APARTMENTS THE SIZE OF TWO ROOMS, WITH KITCHENETTE, FOR PERMANENT GUESTS
CUTAWAY SHOWING TYPICAL ROOM
SKATING RINK IN WINTER, OUTDOOR DINING IN SUMMER
LOBBY
CENTRAL FAN ROOMS FOR AIR-CONDITIONING SYSTEM THROUGHOUT BUILDING
ELECTROSTATIC DUST CATCHER BEHIND EACH INTAKE CLEANS NEW AIR
"TERRACE GARDEN" COCKTAIL LOUNGE
ELEVATORS SERVING HOTEL ONLY
ELEVATORS TERMINATING IN HOTEL LOBBY
1 2 3 4 5 6 7 8
SHOE STORE
DRUGSTORE
5-FLOOR CLOTHING STORE WITH 2 FLOORS OF OFFICES ABOVE IT
STAIR TO CAFETERIA
JEWELRY STORE
AIR-INTAKE LOUVER FOR FAN ROOM OVER ELEVATOR LOBBY
HOTEL ENTRANCE
LARGE CAFETERIA UNDER FIRST FLOOR OF CLOTHING STORE

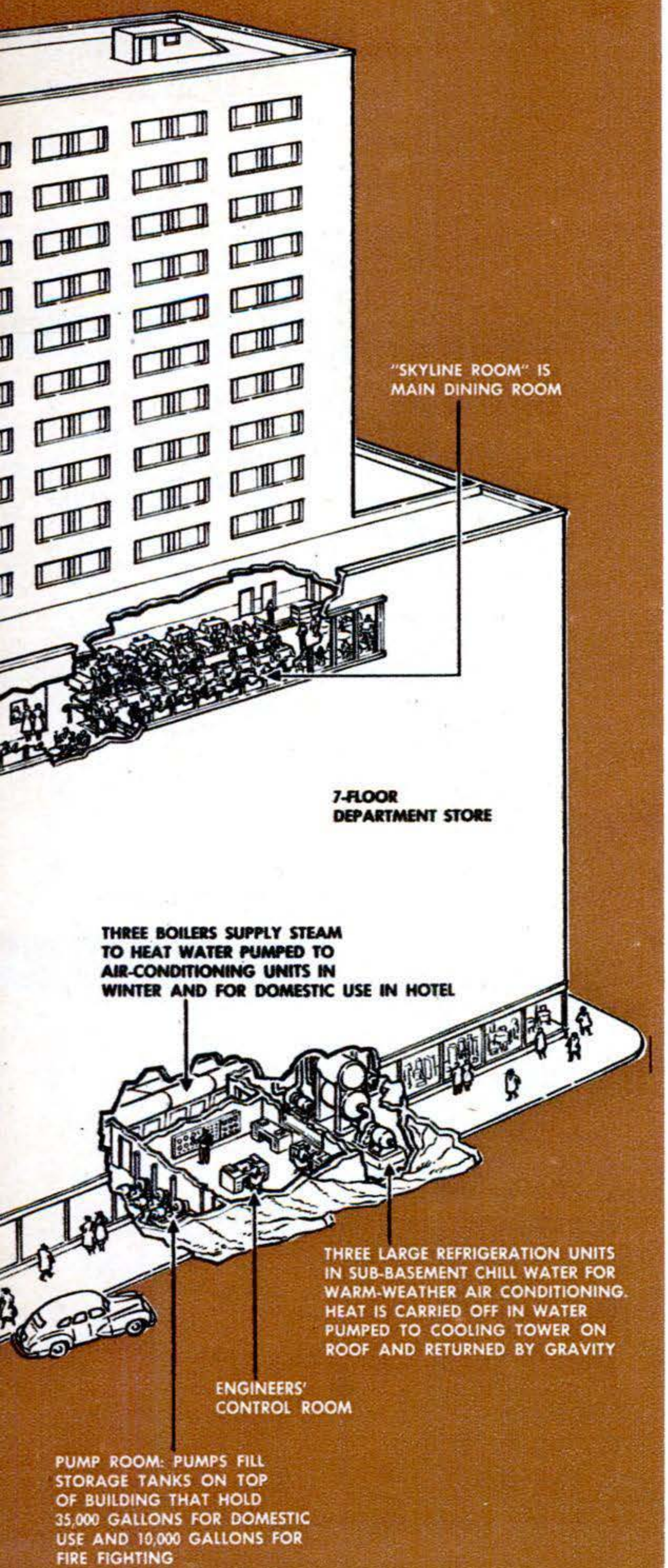
Penthouse Hotel Has Ideas For Small Houses

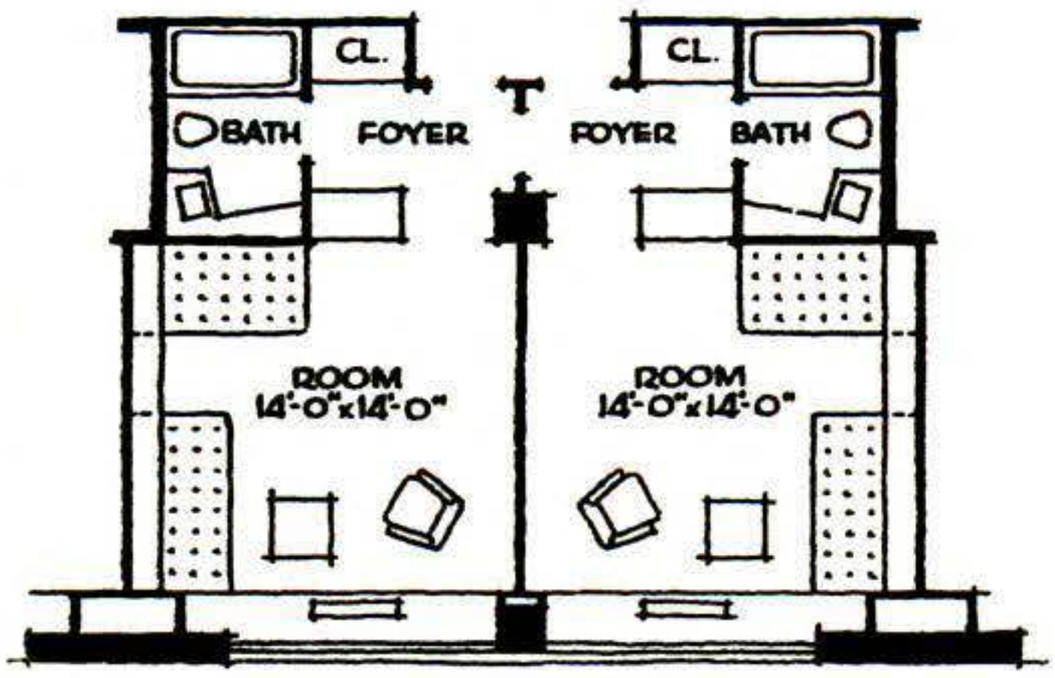
By Howard C. Jensen

THE world's newest and most modern hotel, the Terrace Plaza in Cincinnati, guarantees that you won't feel crowded out of your room in the daytime by furniture useful only during your sleeping hours.

Its 400 rooms have sofas that slide out electrically at night to become beds. All also have built-in indirect lighting, huge picture windows, and air conditioning. The following two pages show the room features in detail *and how you can use the same ideas in your own home.*

Shown in the drawing at left are many hidden features jammed into the building to make you more comfortable—and to make your comfort easier for the hotel management to maintain. An annex to Cincinnati's largest hotel, the Netherland Plaza, the new one is planned for people who want a liveable room away from the usual conventions, hubbub, and rug-cutting. For this reason the designer dispensed with the usual first-floor lobby and put the ground space to more profitable use for several stores and shops.





Floor plan of two rooms that can be connected as suite shows use of space during day. In each room seven people can sit comfortably. As living rooms they escape usual bedroom atmosphere.

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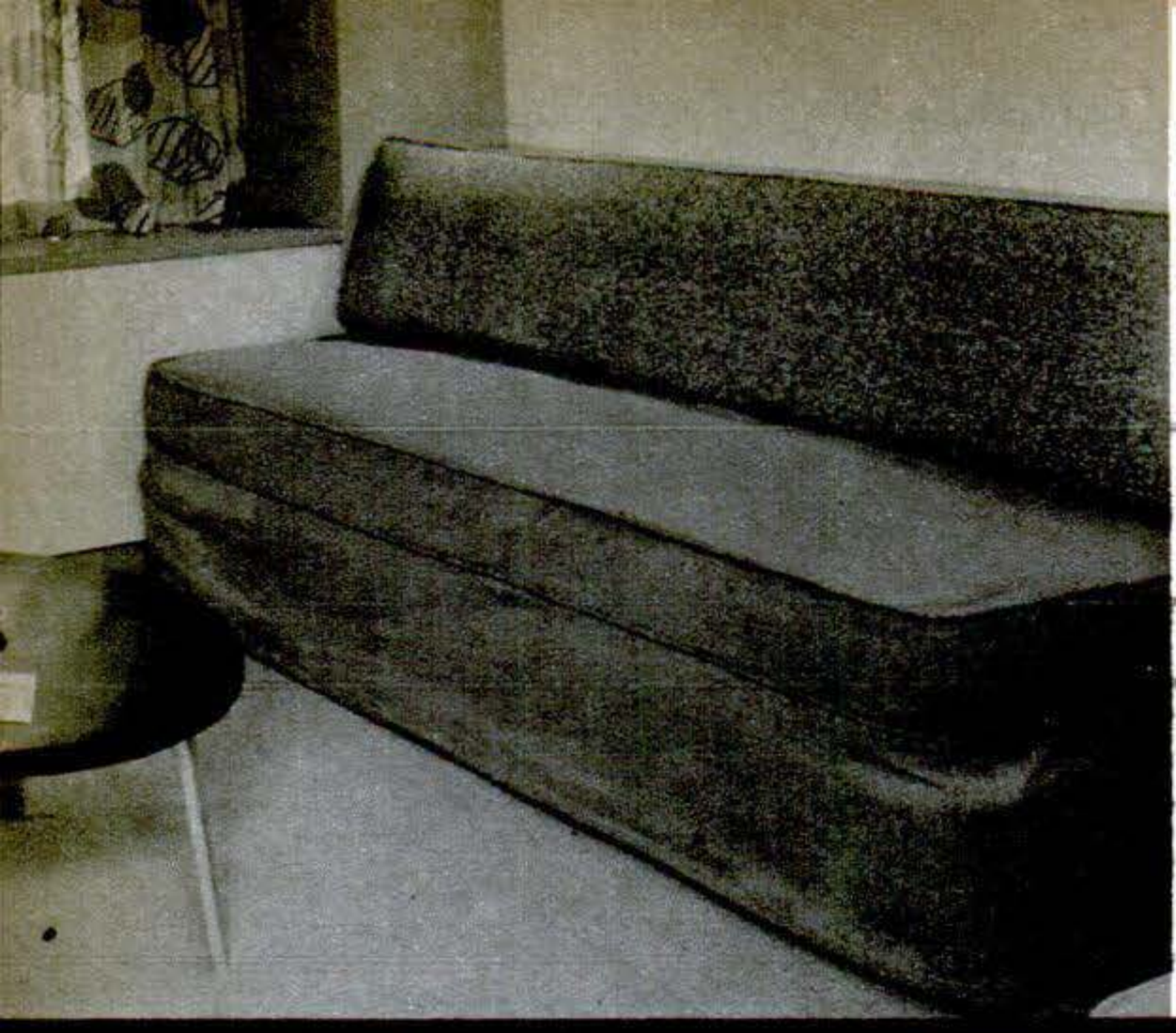
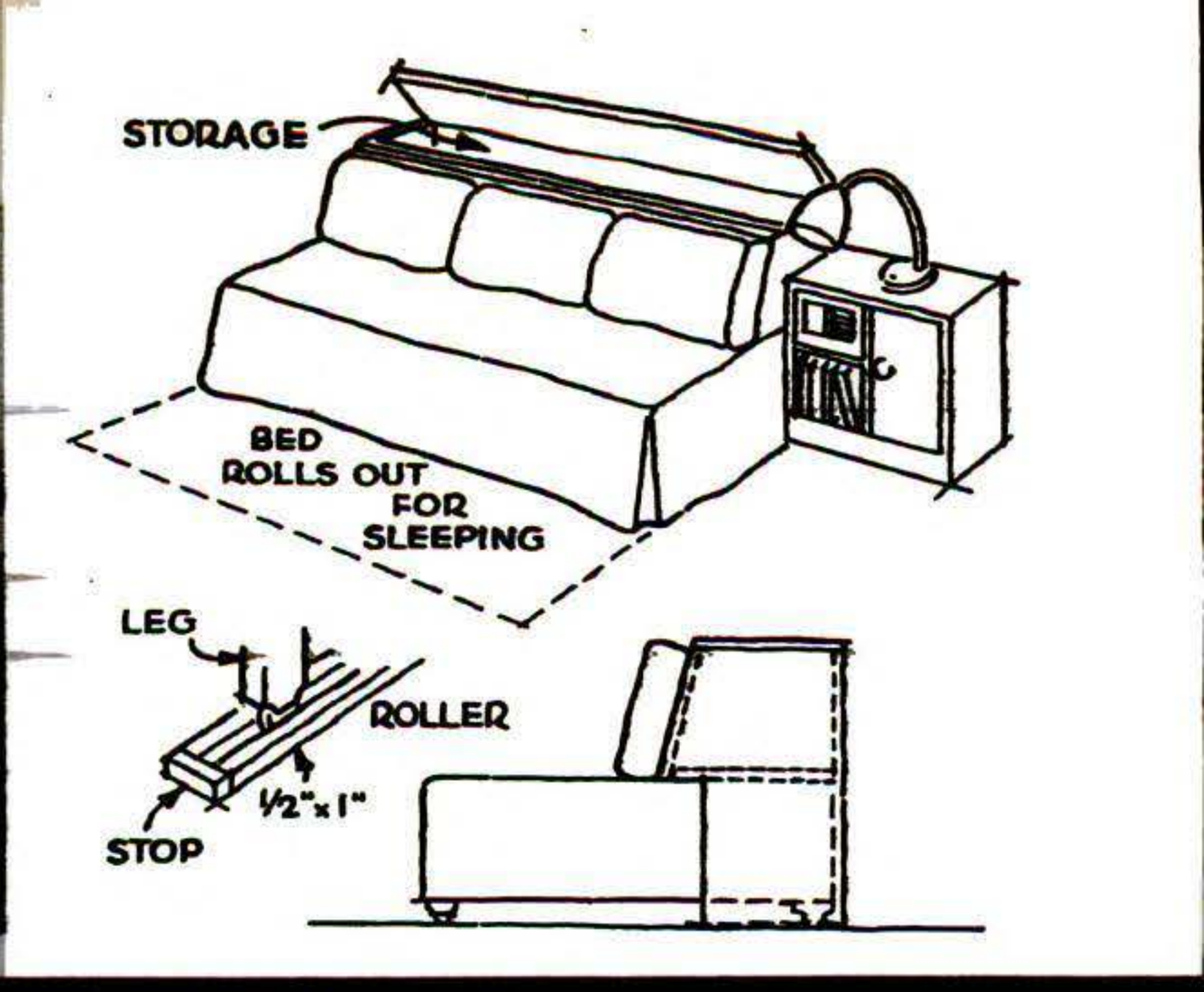
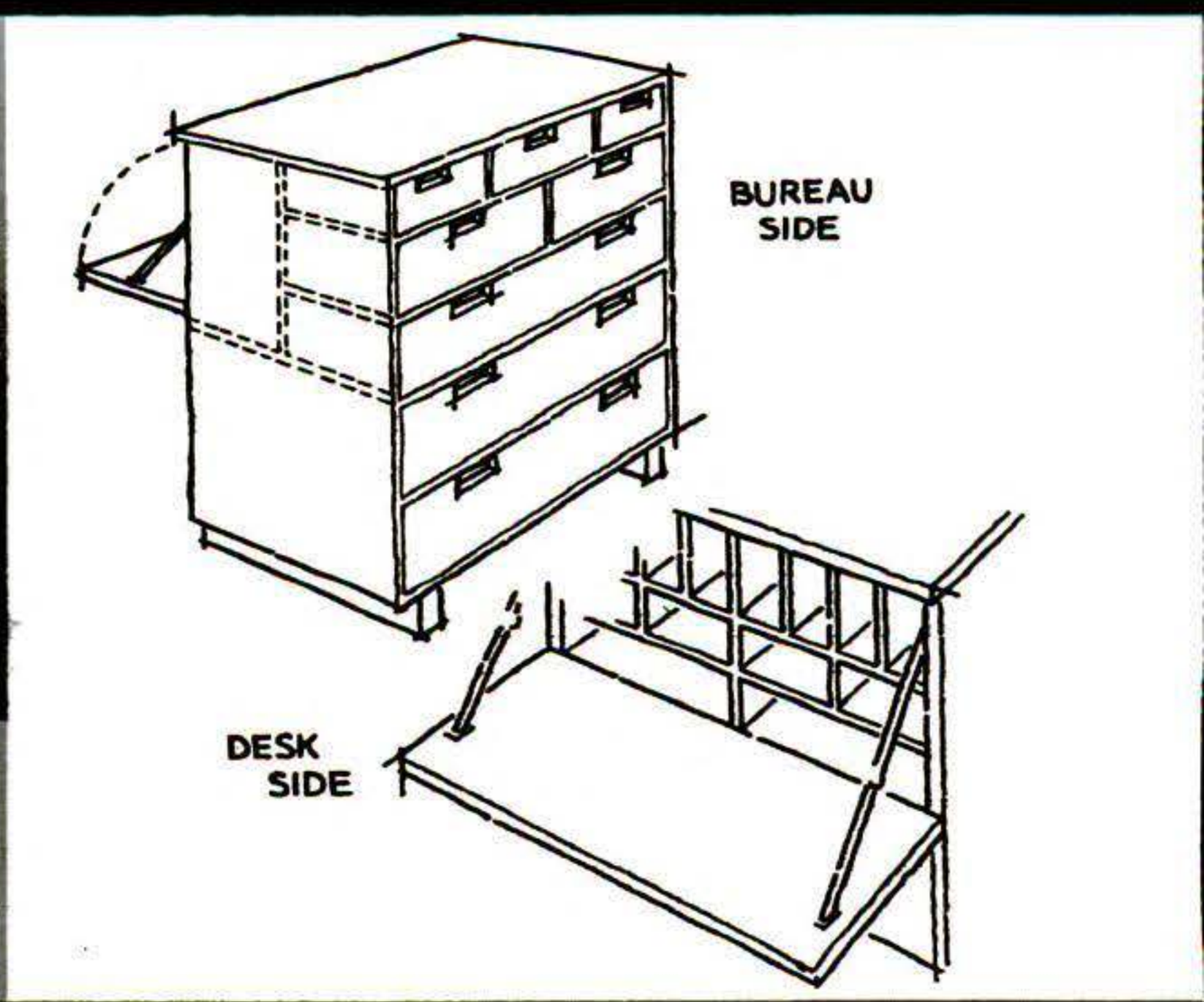
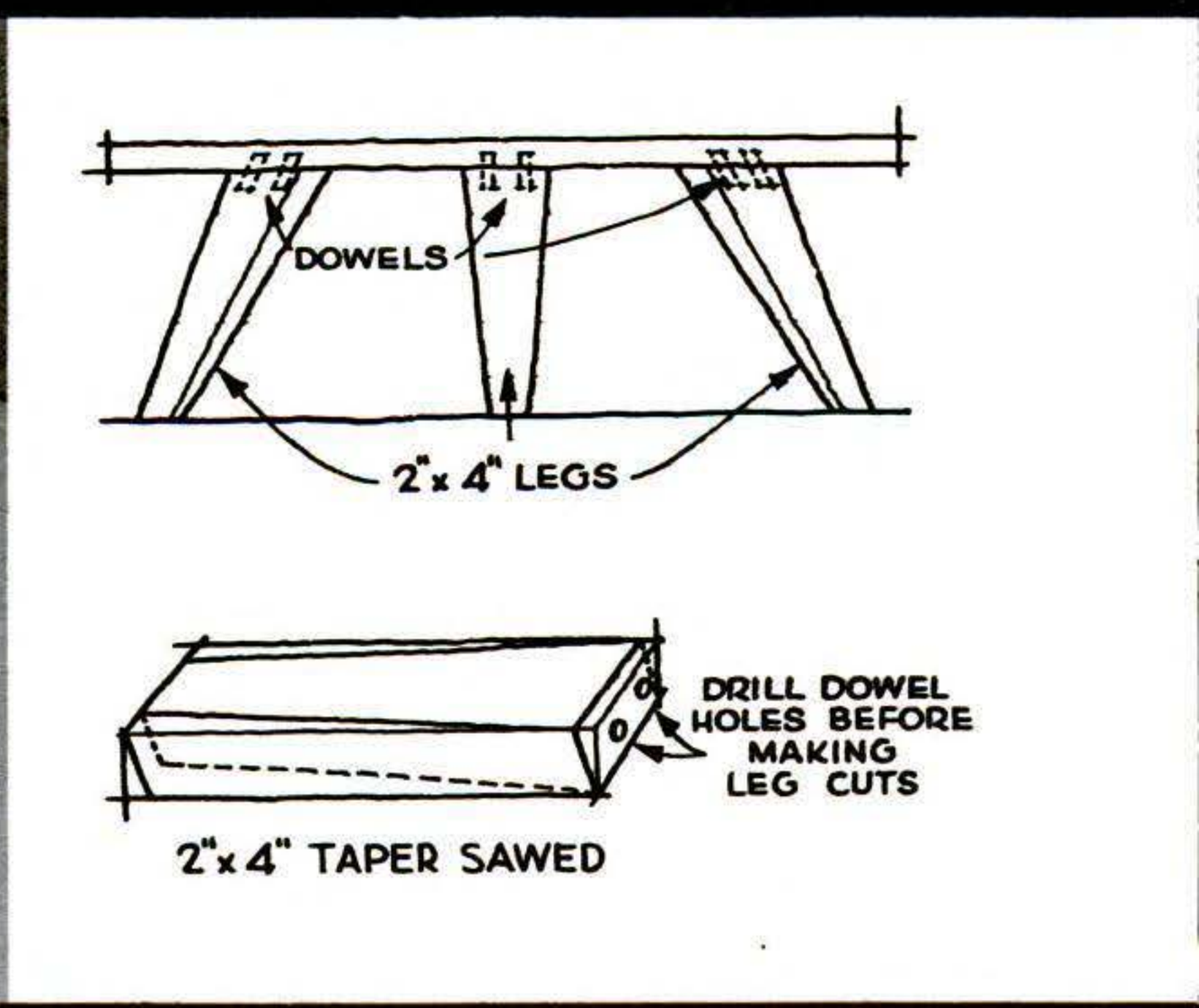




A cabinet-backrest over sofa-bed turns your bedroom into a living room.



This combination desk-dresser not only saves space but is convenient to use.



You can make this table from one piece of plywood and three pieces of 2-by-4.

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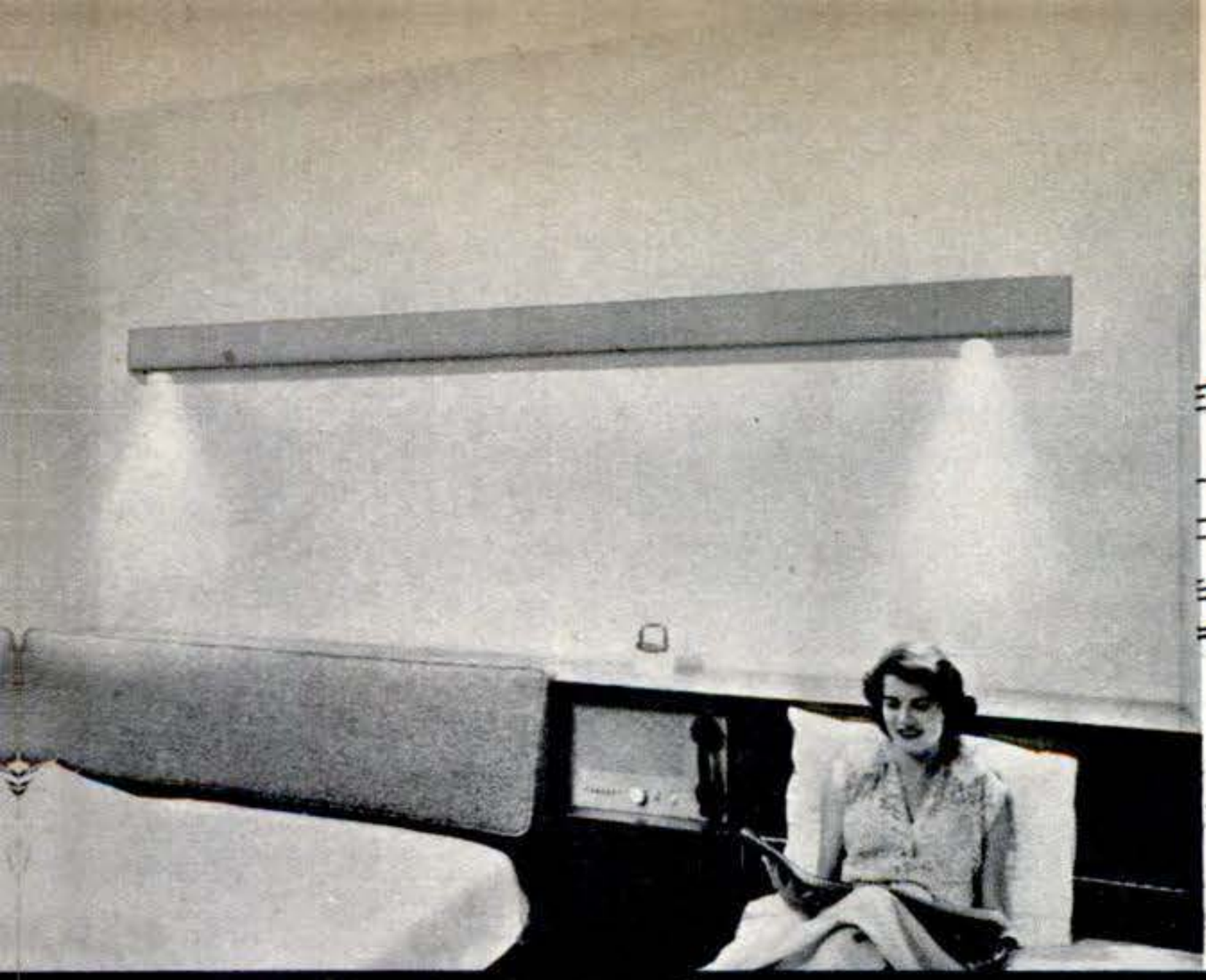
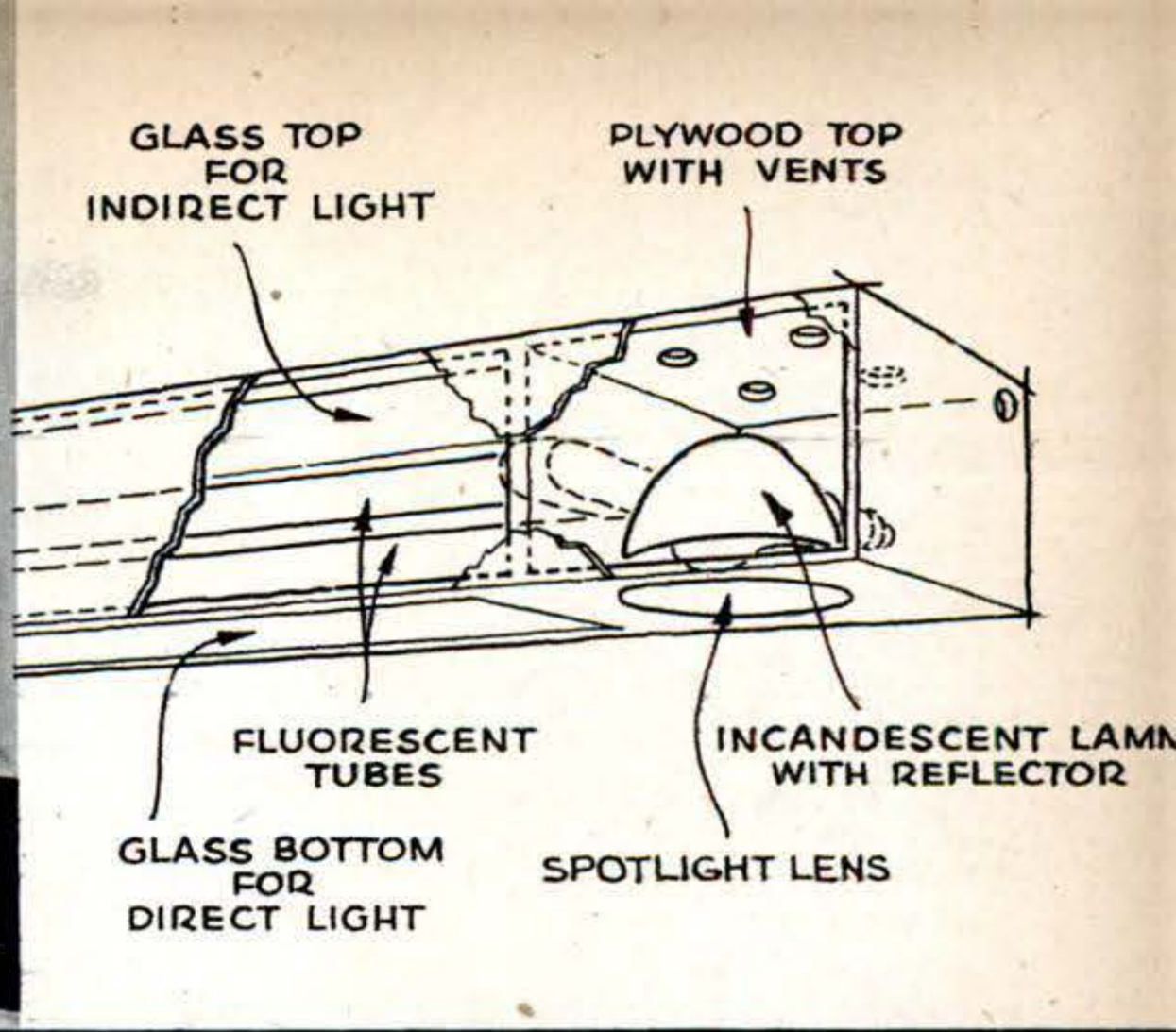
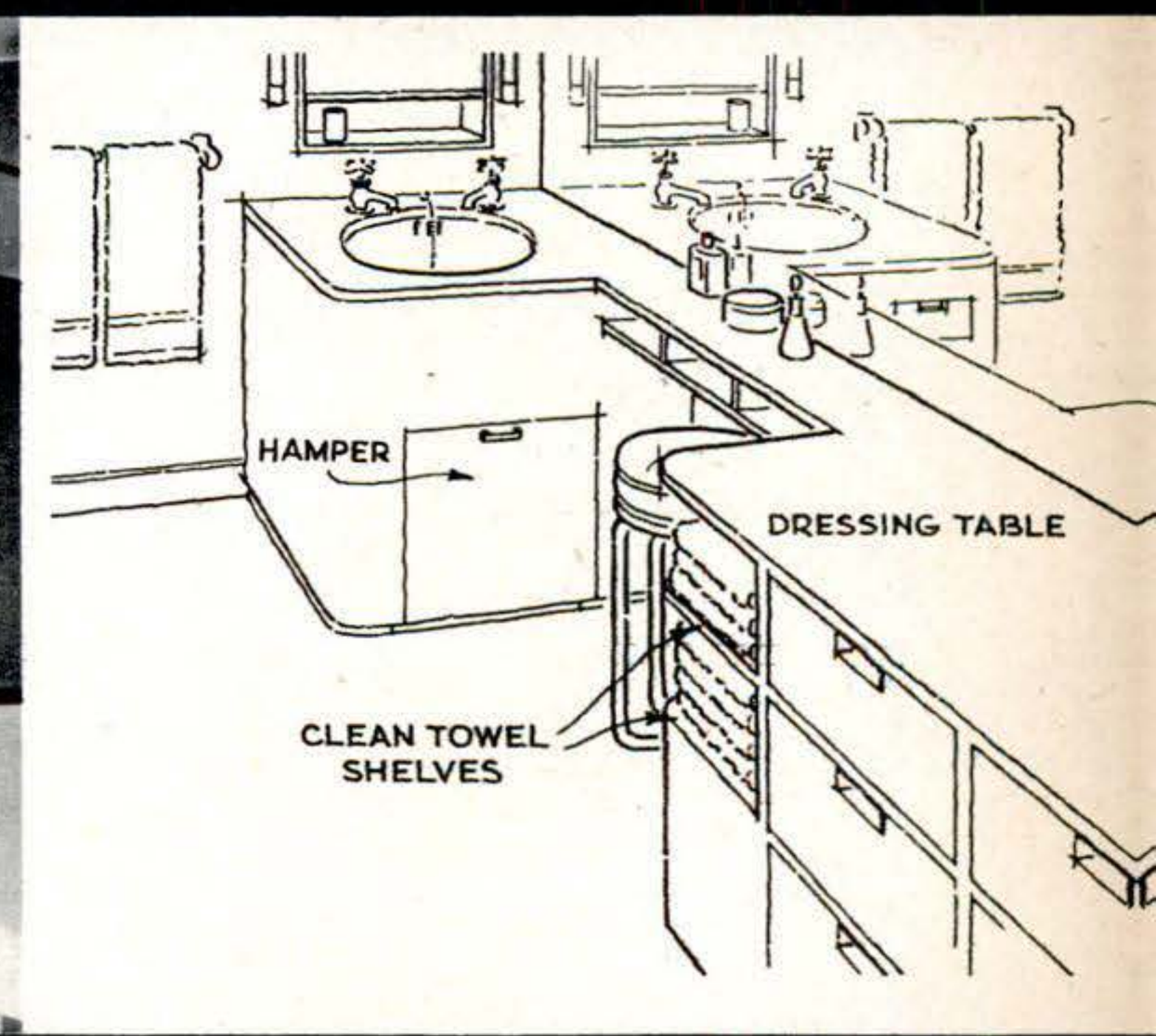
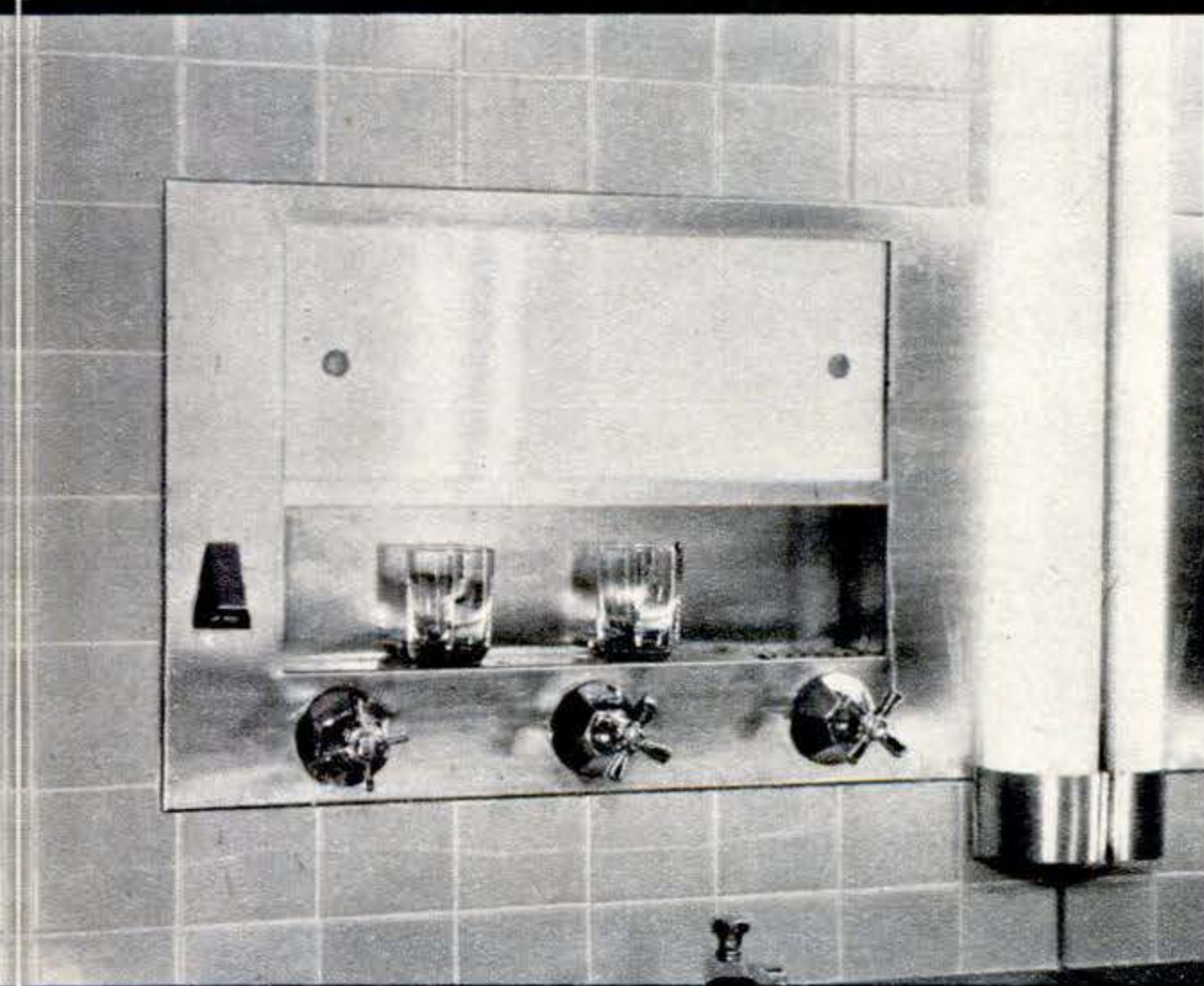


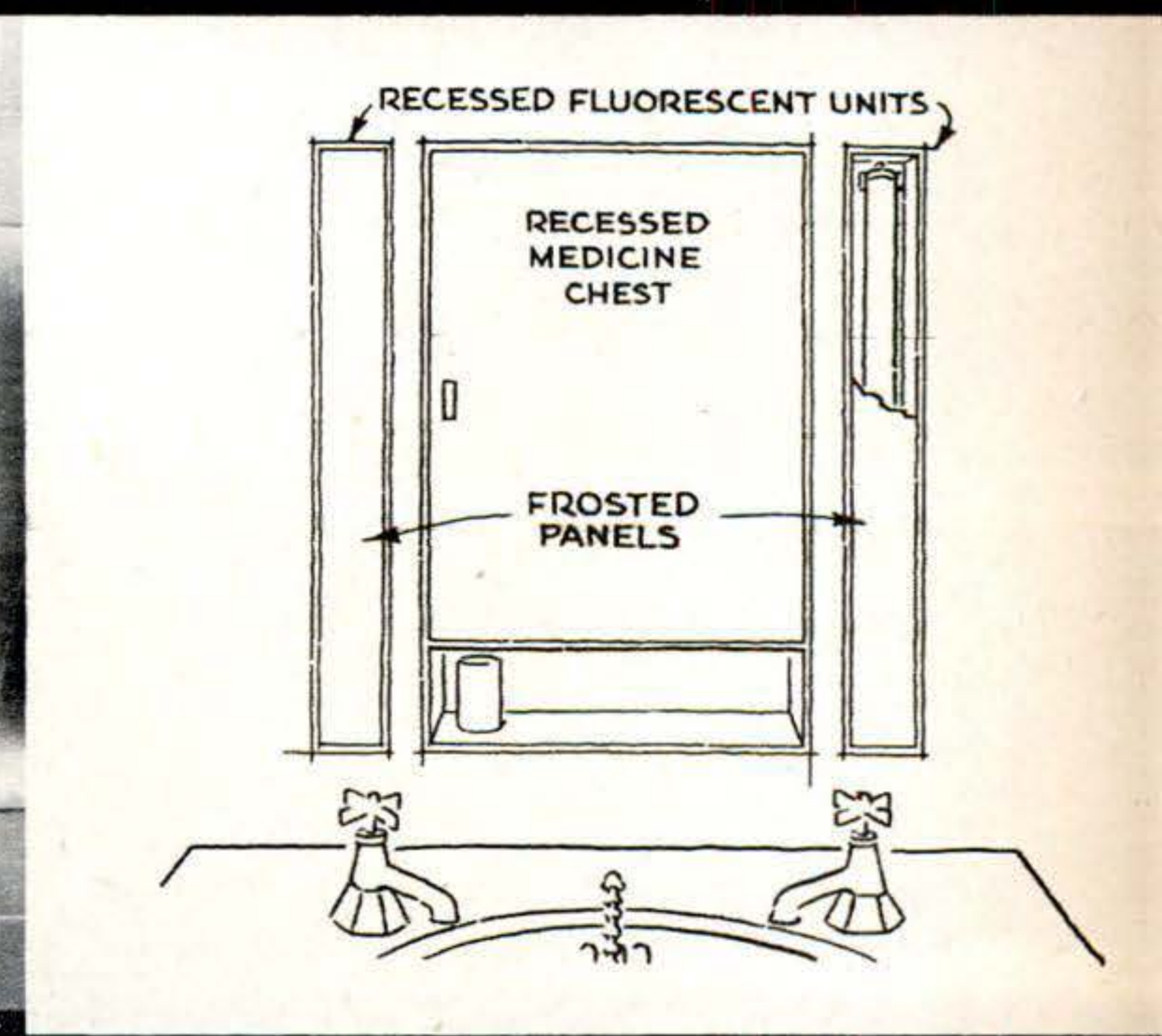


This duplex lighting fixture is handsome, simple to make, easy on your eyes.



Plywood streamlines the bathroom fixtures and gives additional storage space.





Recess the medicine chest and install fluorescent lamps alongside the mirror.

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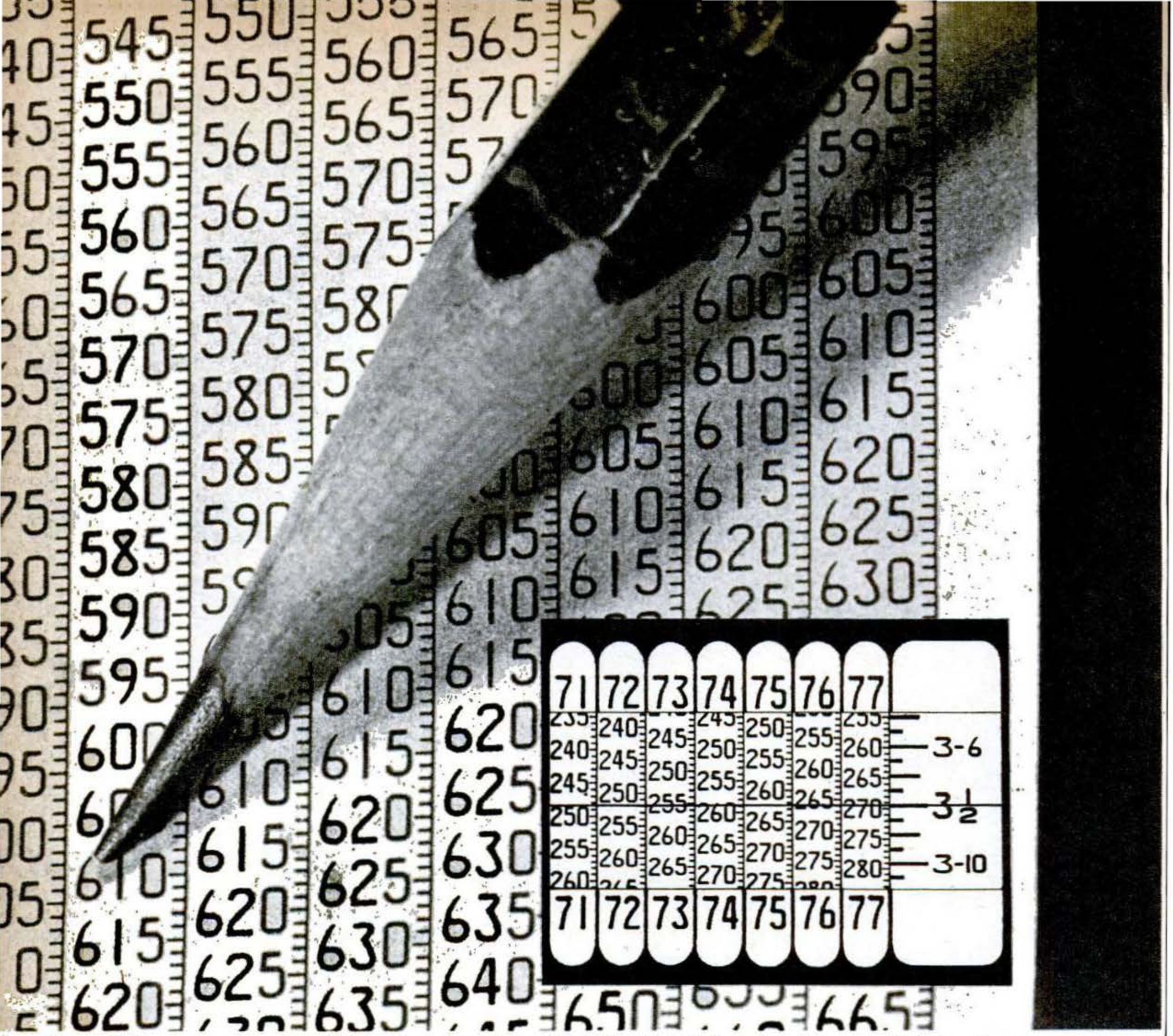

Size of figures on new scale's price chart is shown by comparison with pencil. Inset shows them as they appear through magnifying window. If printed that size they would fill a chart 375 ft. tall. Actually, 129,000 of them are printed on a thin sheet of aluminum only 13 by 27¼ in.

New Scale Solves 129,000 Problems

THIS new scale for grocers and butchers can figure to the penny what you'll have to pay for a sack of beans or a cut of steak at any of 129,000 different combinations of weight and price.

To do so, it carries 45,000 more figures on its price-computing chart than most prewar scales. Reason for this increase: soaring prices. Computations were going right off the top of the old charts.

The problem was how to get all those figures on a chart of manageable size. The Toledo Scale Co., of Toledo, O., solved it by radically reducing their size—and mounting four two-power magnifying glasses in front of the chart as sliding windows.

The new scale, called the Guardian 70 Duplex®, has another new feature: two pendulums, instead of one, to offset the weight of whatever is put on the platform. If a single-pendulum scale is tilted, its pendulum is thrown off balance. The price chart then shows a wrong figure. Two pendulums, however, correct each other's errors.

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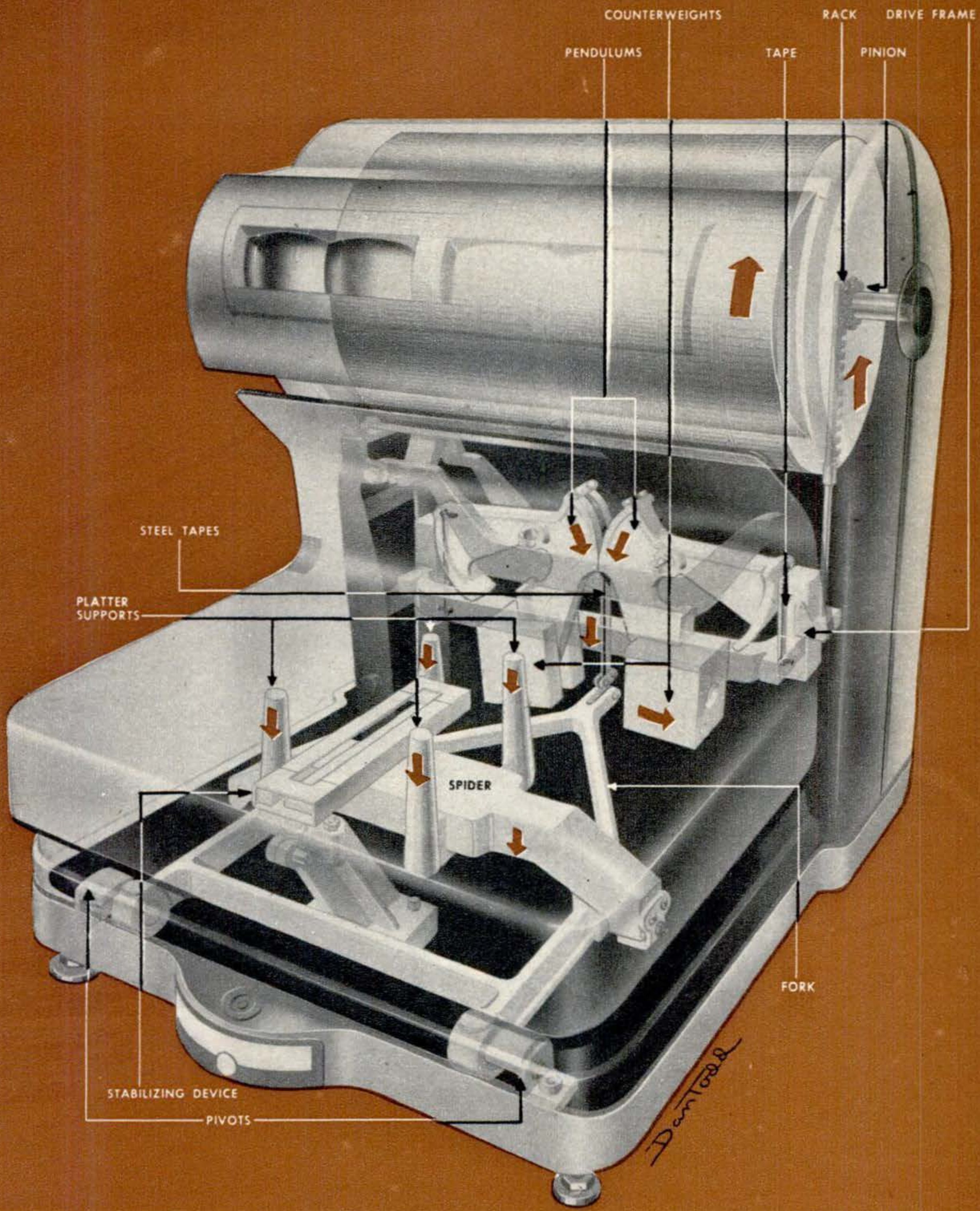


How the new scale works: Weighing platter rests on four supports. These push down on pivoted spider. Fork of spider pulls down on steel tapes, depressing pendulums. Counterweights rise in arc at each side to balance weight on platter. As weights rise, tapes on ends of pendulums pull up on drive frame. Drive frame pushes up rack, which turns pinion on shaft and revolves price chart on drum in front of magnifying windows.

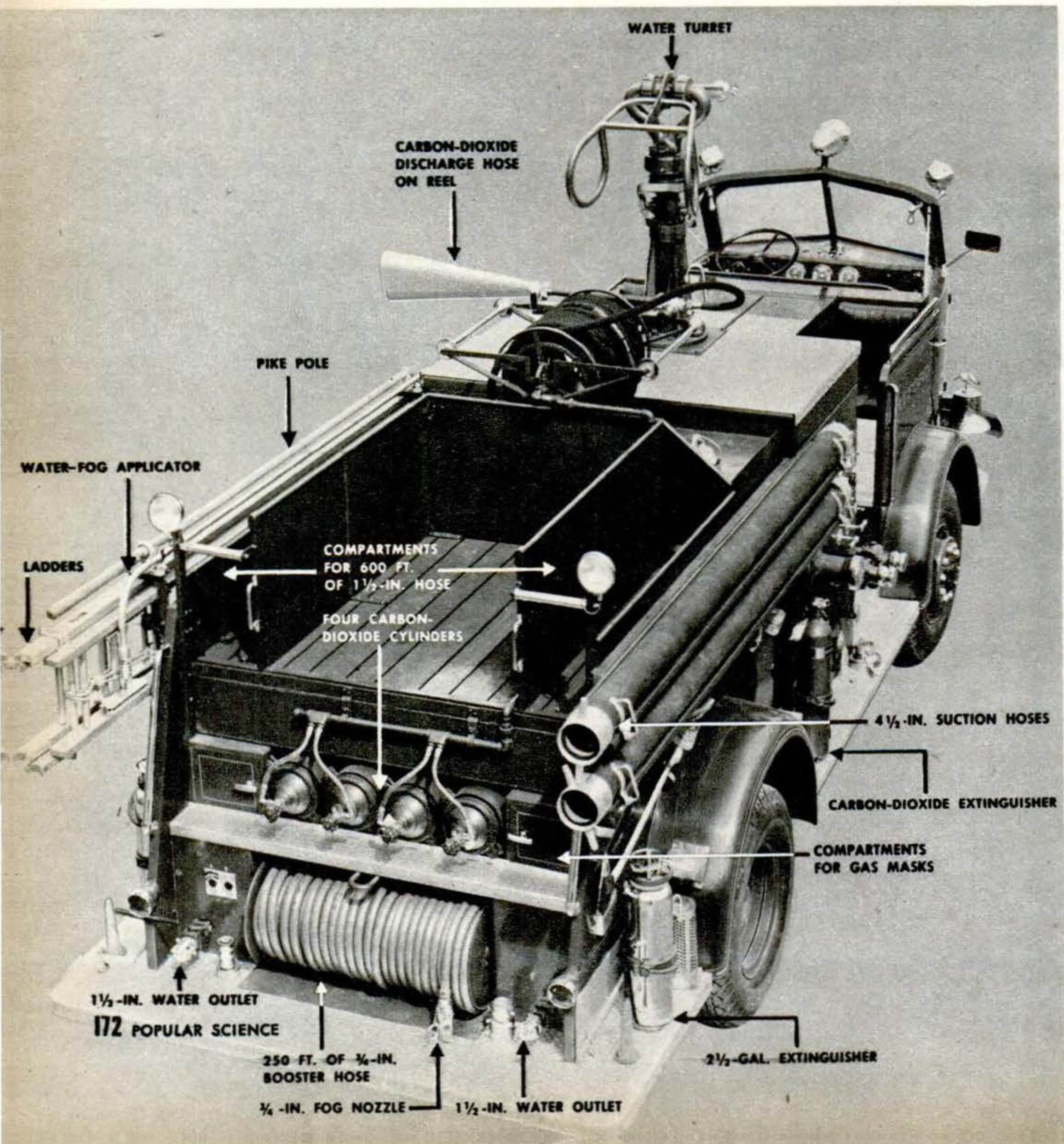
Airport fire truck, shown dousing a blaze, can throw 750 gal. of water a minute or 1,200 gal. of foam and 300 lb. of carbon dioxide. It has a four-wheel drive and low-pressure tires.

New Crash Truck Fights Fires Fast

THIS crash truck to fight airplane fires can whizz up to a burning plane with water and foam nozzles in full operation even before the driver puts on the brakes. That's because it has two engines—one to drive the truck, one to provide water pressure.

The second engine also permits moving the new airport fire truck without shutting down the hose lines if a wind shift endangers the firemen.

Fully equipped, with five firemen on it, the truck weighs about nine tons. It is made by the American-La France-Foamite Corp., of Elmira, N. Y.



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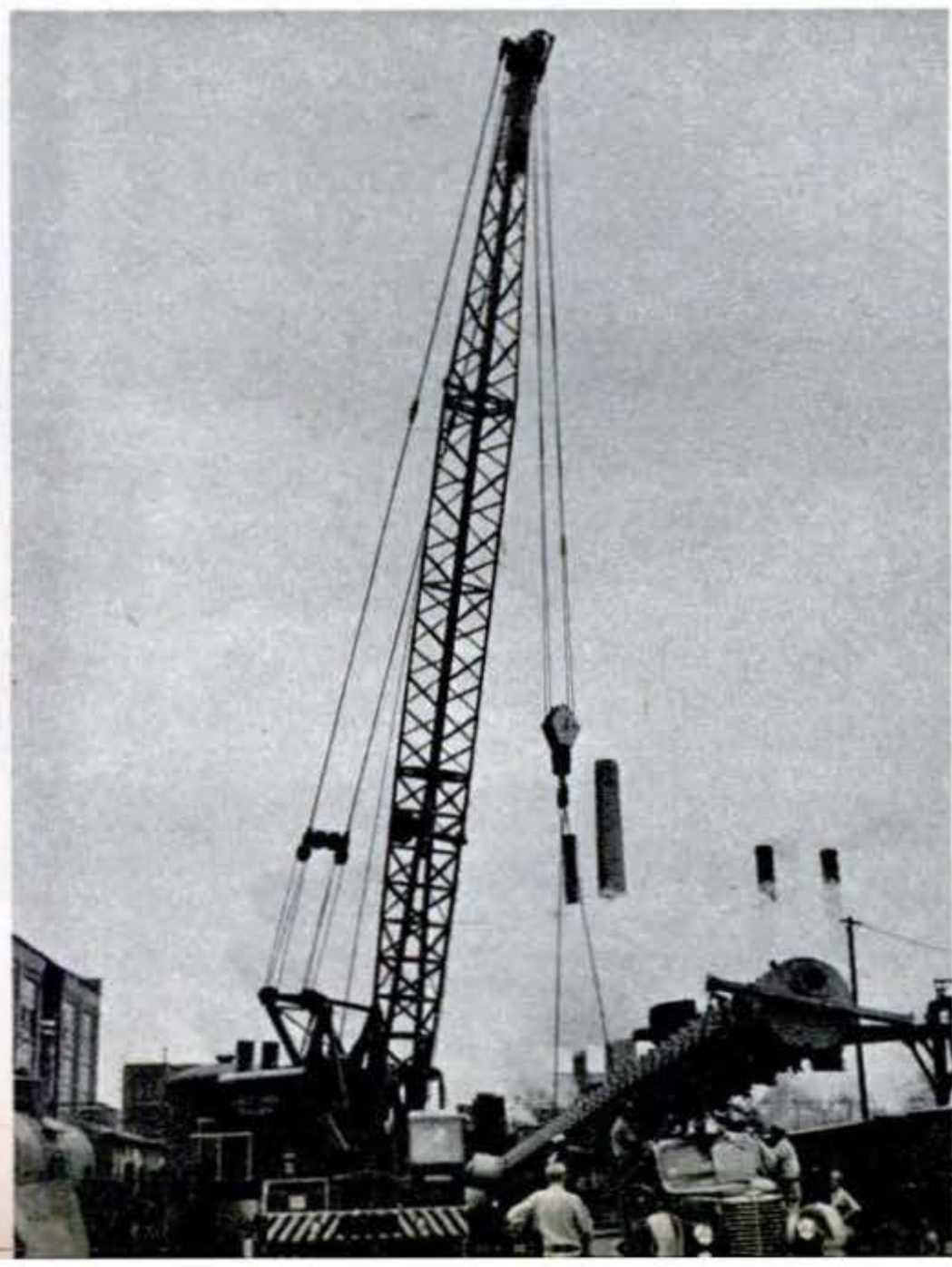
Robot Drills Crankshafts

THIS battery of electric drills bores 16 deep, angular oil holes in 60 Ford crankshafts an hour—without a hand guiding the job. One operator loads the shafts onto the 39-foot production line, and another lifts them off at the end. Automatic controls do all the rest, even withdrawing a drill if accumulated chips threaten to snap it off. Shuttle bars move the shafts from one drilling station to the next, and hydraulic vises hold them at each stop.

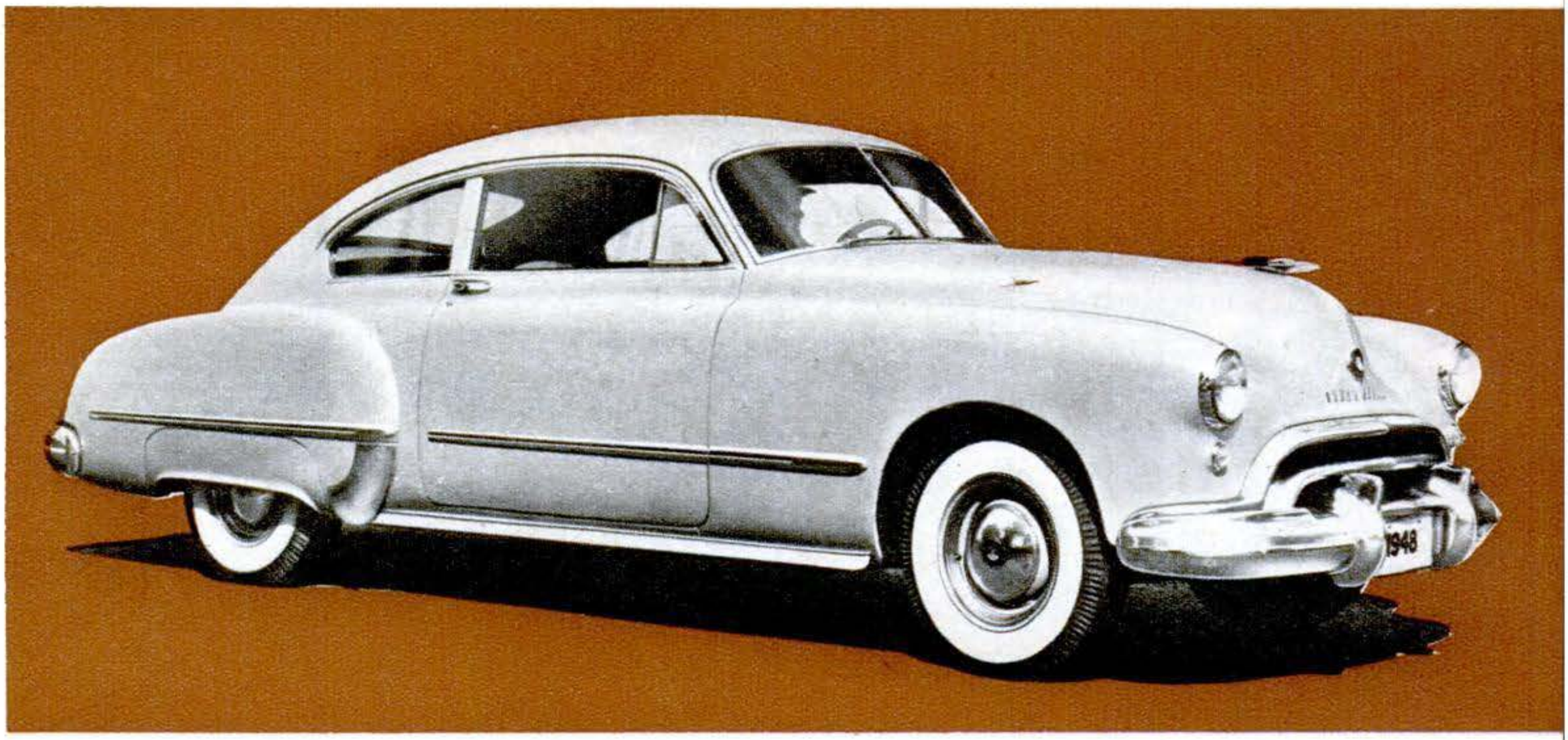
Biggest Motorized Crane

THIS rubber-tired motor crane (below), reported the world's biggest, can lift 45 tons—nearly three-fourths its own weight. A 225-hp. Diesel propels the Lorain® giant at 1¾ to 18 m.p.h. A second, 164-hp. engine powers the turntable, 100-ft. boom, and winches.



Painter Rides Elevator

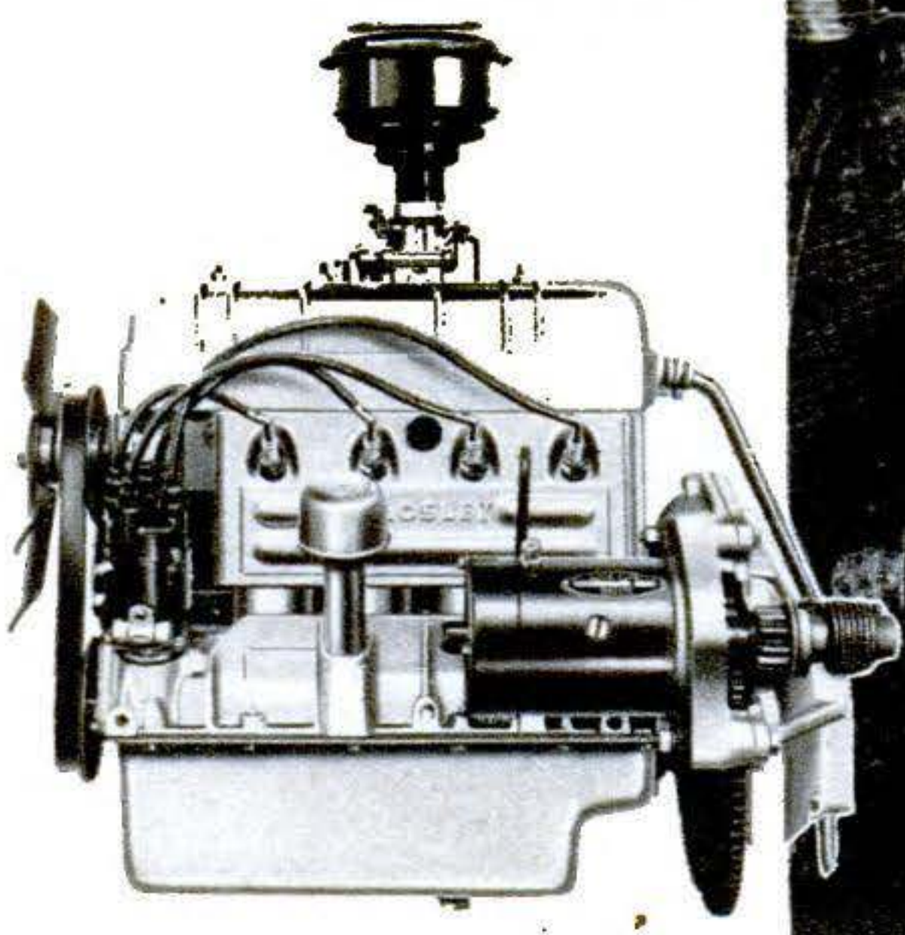
THE one-man elevator below speeds painting the miles of cables that support the San Francisco-Oakland Bay Bridge. Protected from wind by canvas walls, a painter works on four cables that come up through the floor as he lowers the elevator on a wire rope.

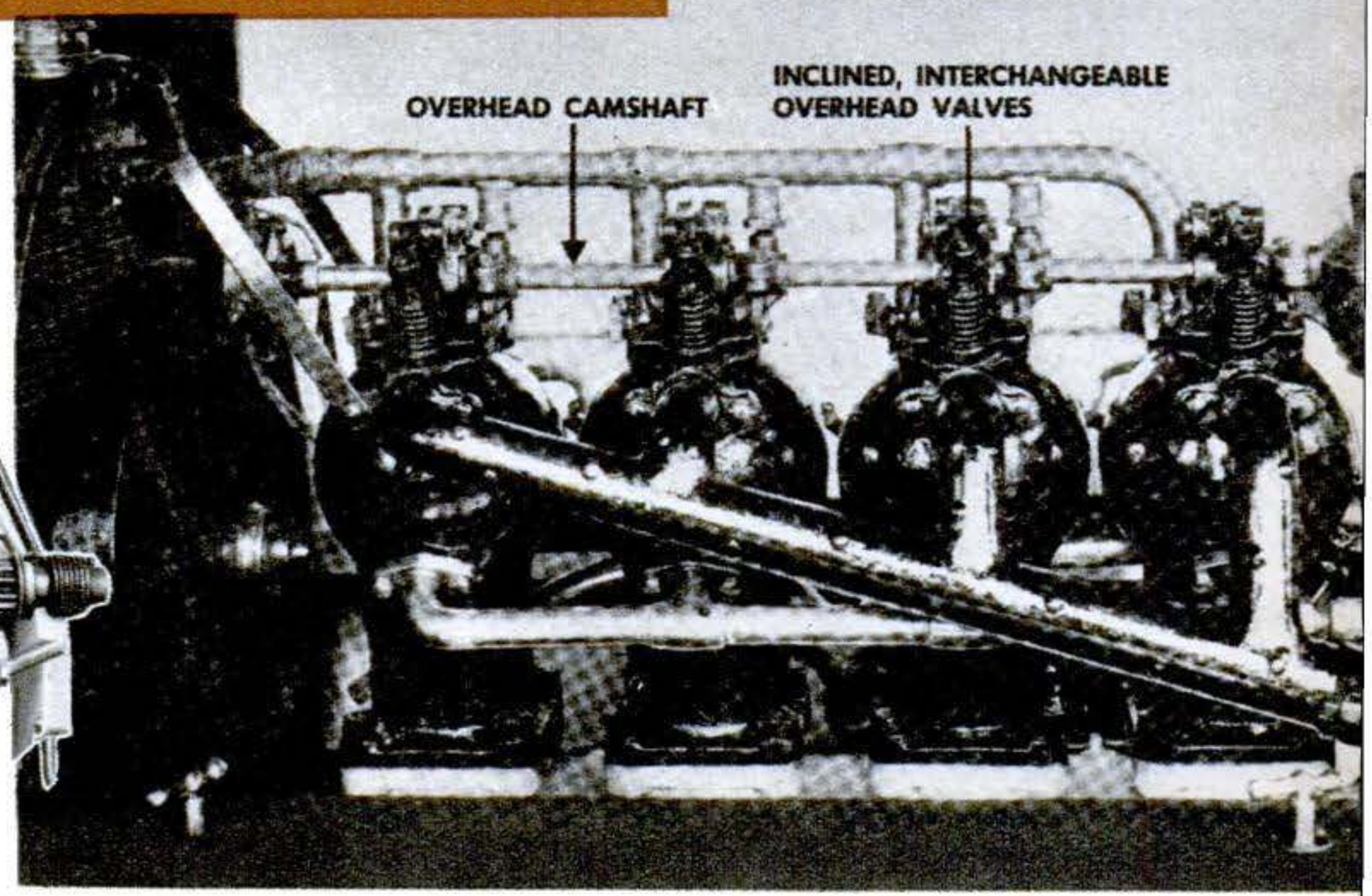


Futuramic® Oldsmobile, 1948 style. How far has the "modern" car progressed in appearance? Look at picture on the opposite page and see for yourself. Automobiles have changed far less than public taste, and memory is short. Yesterday's forgotten fashions are today's "newest thing."

They're Not As New As You Think — By John Bentley

OVERHEAD VALVES AND CAMSHAFT





The valve-in-head engine has long been used in American cars, but it was not until 1946 that the high-efficiency overhead camshaft, for years confined to racing engines, was reintroduced in the Crosley engine at left above. Actually this feature appeared in production automobiles over 40 years ago. The 1906 Ariel engine at right was a good example. This 4-cycle power unit of 28-30 horsepower had not only overhead valves but also an overhead camshaft driven by bevel gears.

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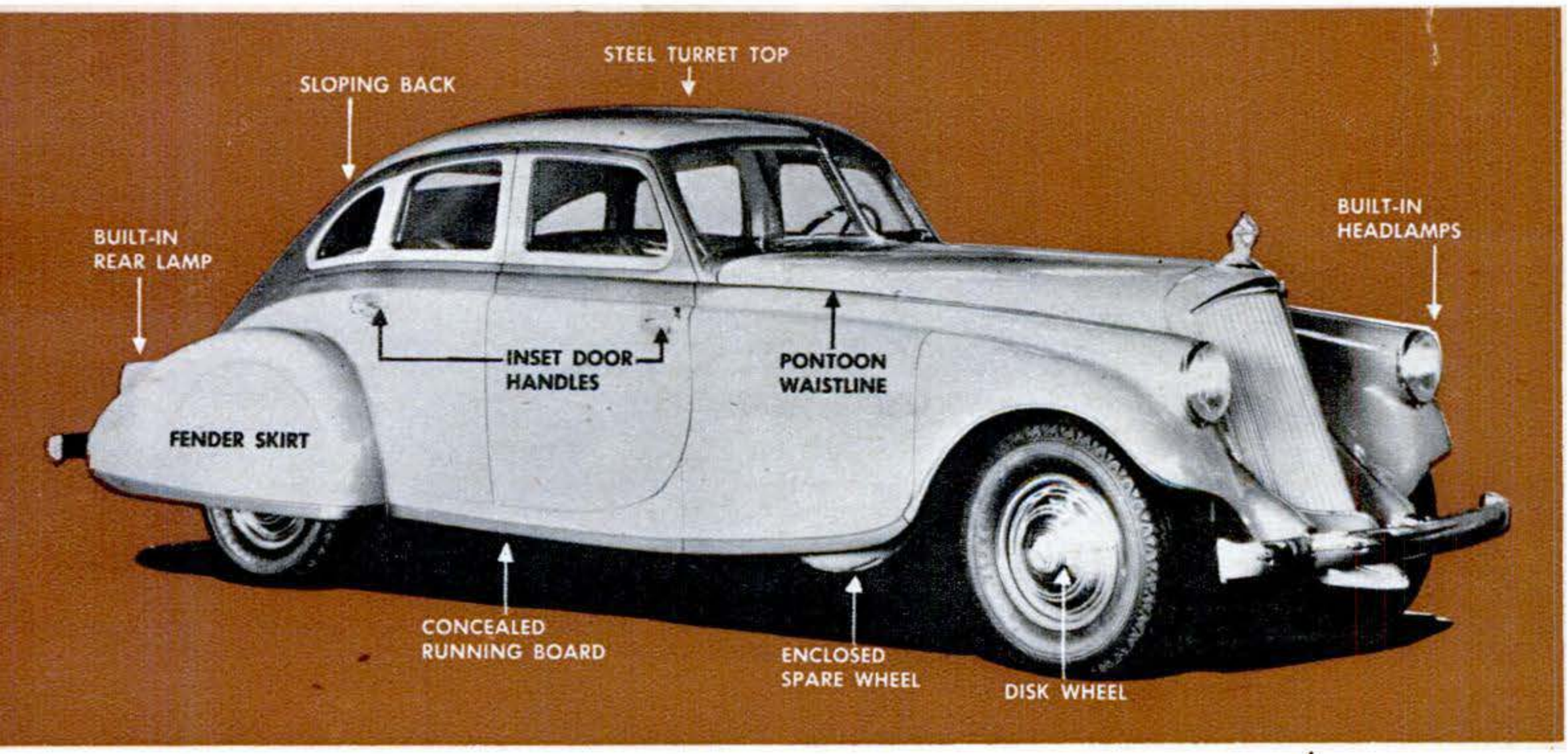
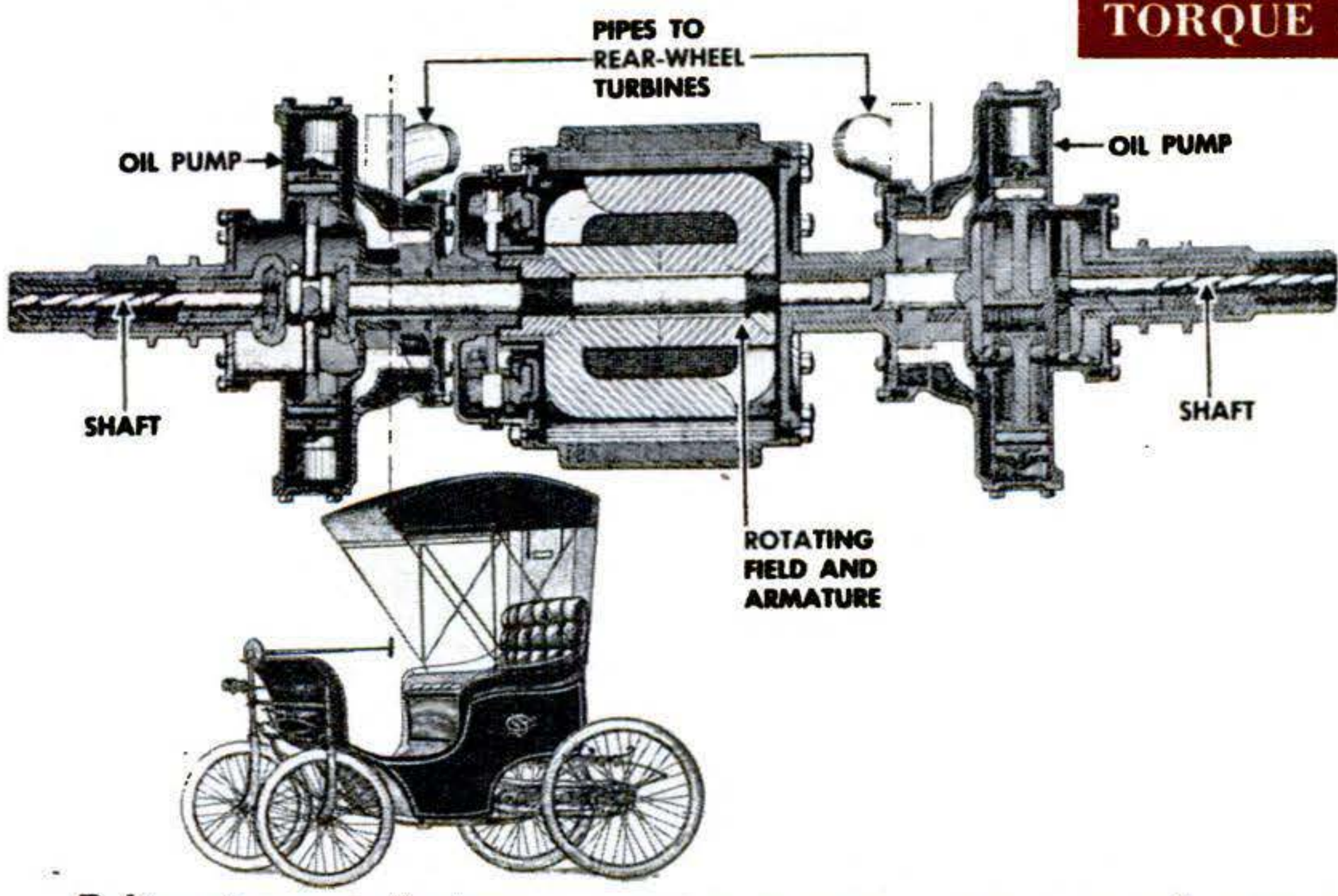


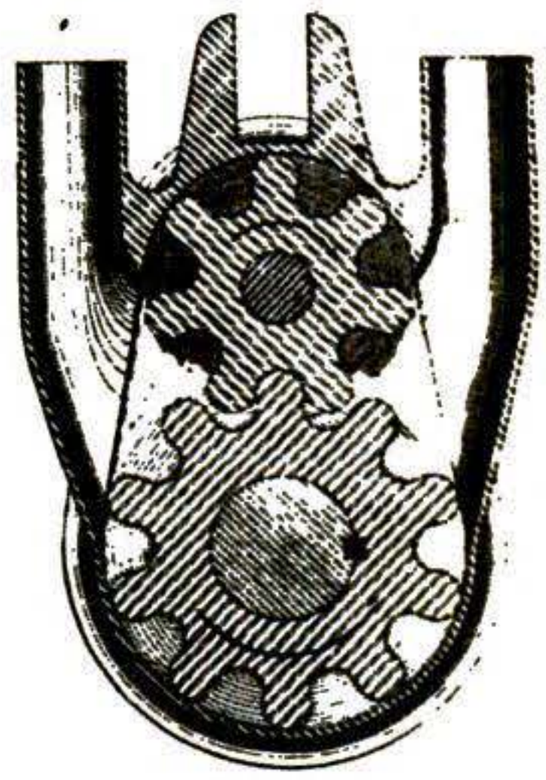
Pierce Arrow "Silver Arrow"®. This car, the sensation of the 1933 New York Automobile Show, anticipated the latest styling by 16 years, but found no sale. Note "pontoon" bodyline with built-in headlamps, steel top, fender skirts, recessed door handles, and graceful, sloping back.

SOME of the "newest" features of the new cars are old stuff to those who know their antiques. Many of these "new" ideas died young because the public wasn't ready for them, or the materials to make them economically were not then available.

Torque converters, steering-post gearshifts, overhead valves, front drive, rear-engine mounting, disk wheels, inter-axial seating, balloon tires, four-wheel brakes, coil suspension, three-abreast seating, underslung frames, the V-8 power unit, and the extensive use of aluminum in automobiles came and went decades ago, together with so-called "modern" styling. Some of these ideas go back even to the turn of the century.

TORQUE CONVERTER





Believe it or not, the torque converter—an automatic device providing variable power ratios by means of a fluid coupling—is 54 years old. In 1895 the Dey-Griswold Co., of N. Y., designed a torque converter for use in an electric phaeton. A battery-operated motor rotated twin oil pumps that forced oil along pipes to fluid-gear turbines connected to the rear wheels. On downgrades, the pumps drove the motor, which then became a generator and charged the battery.

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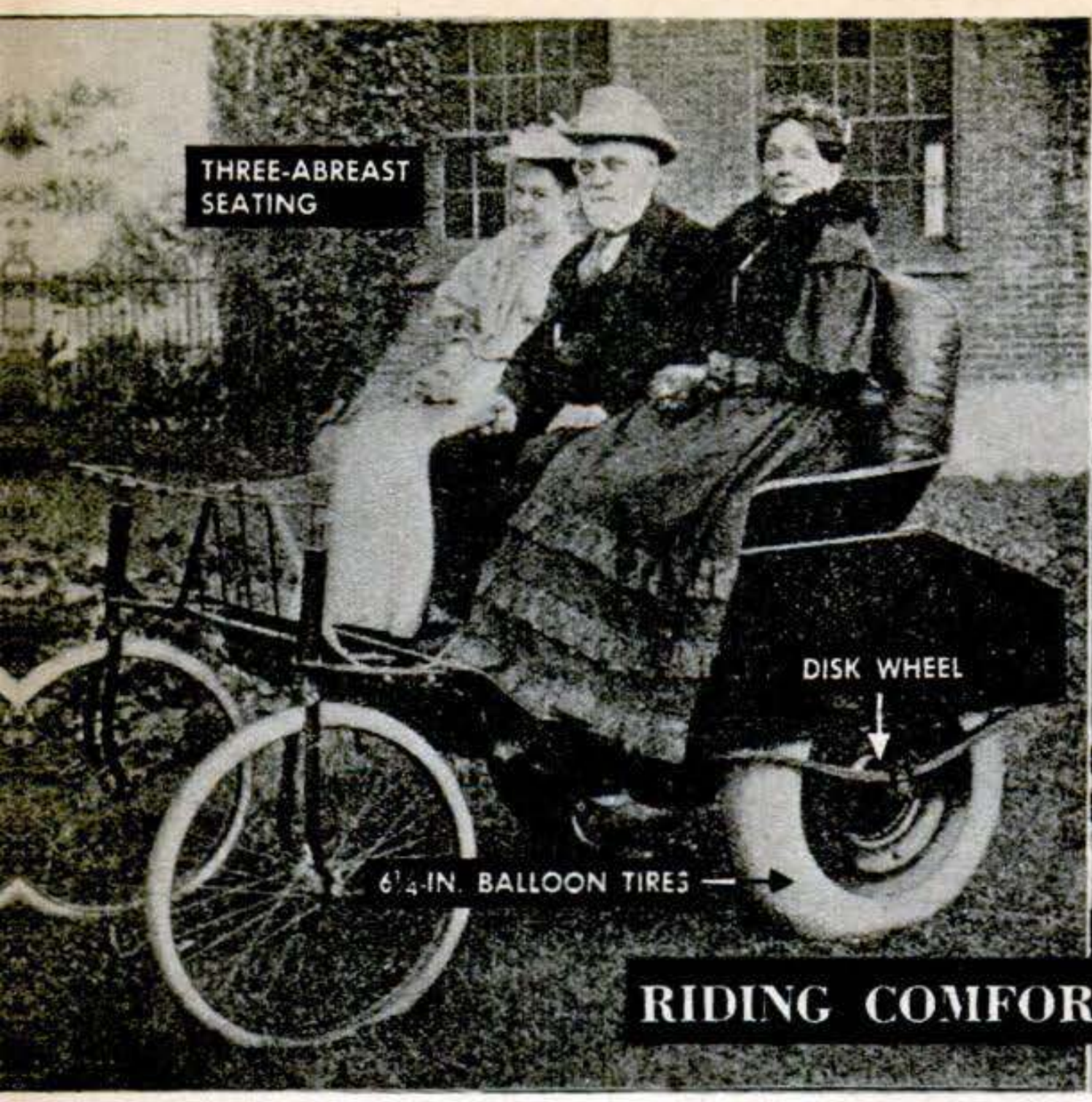
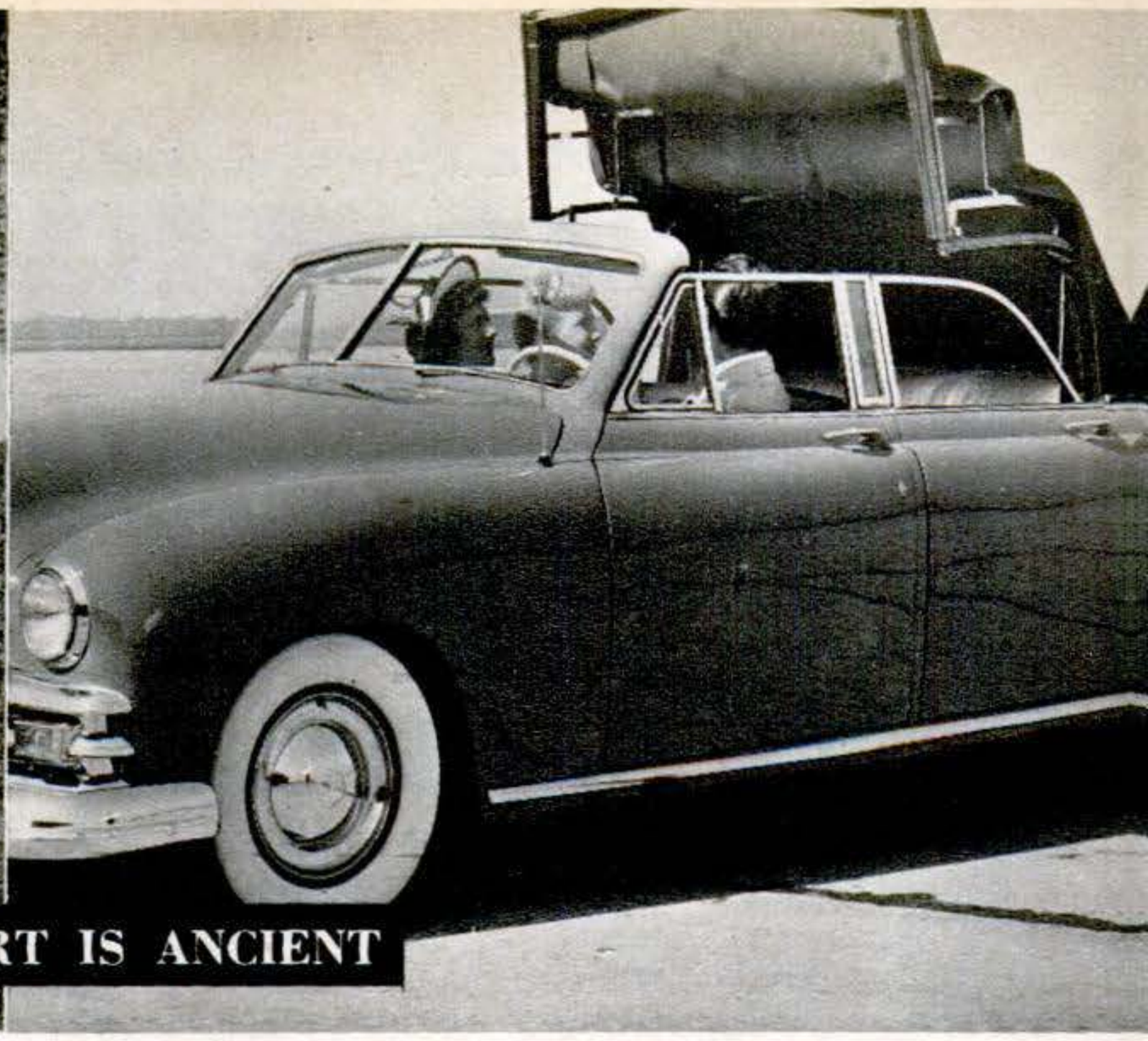
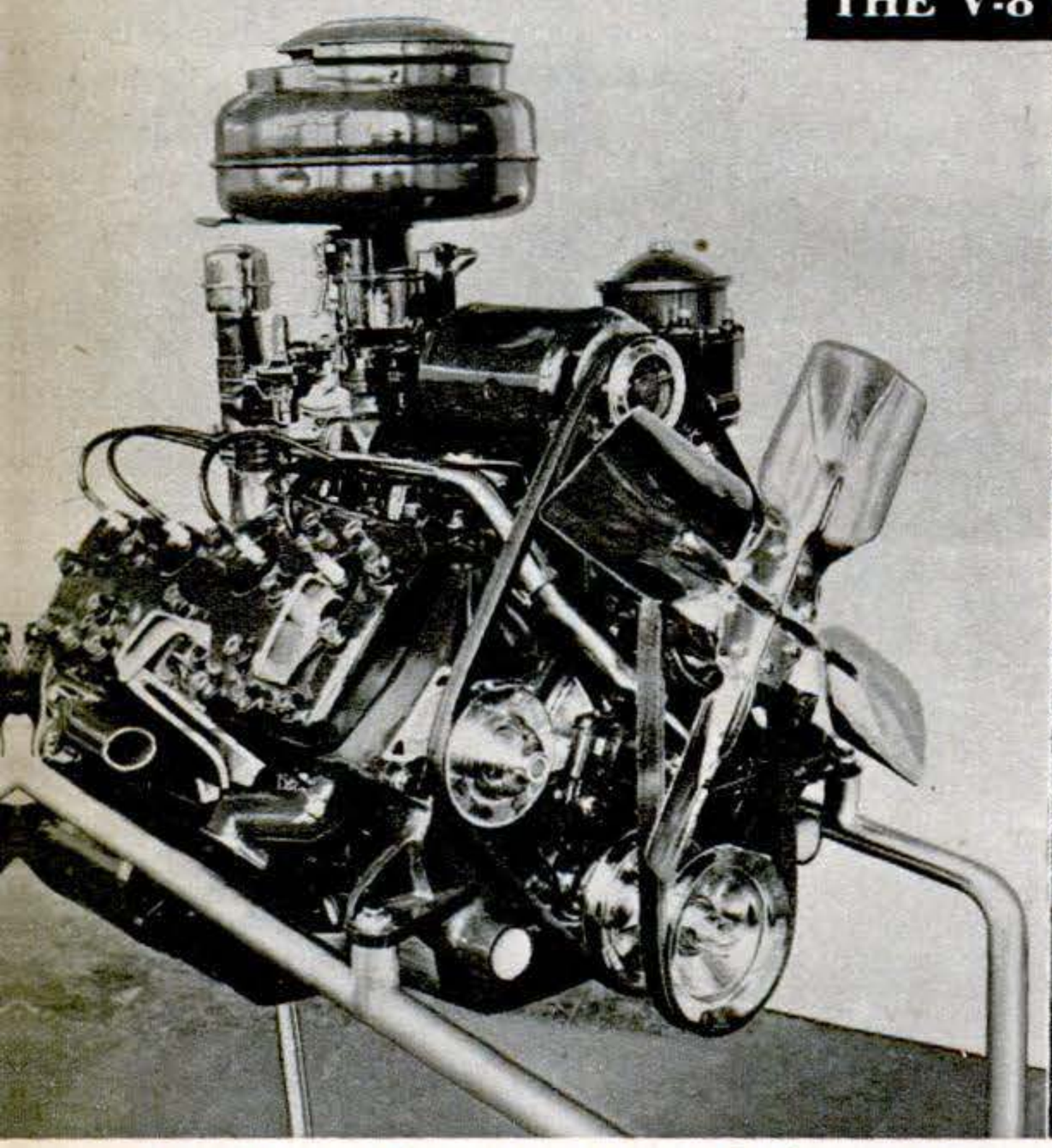


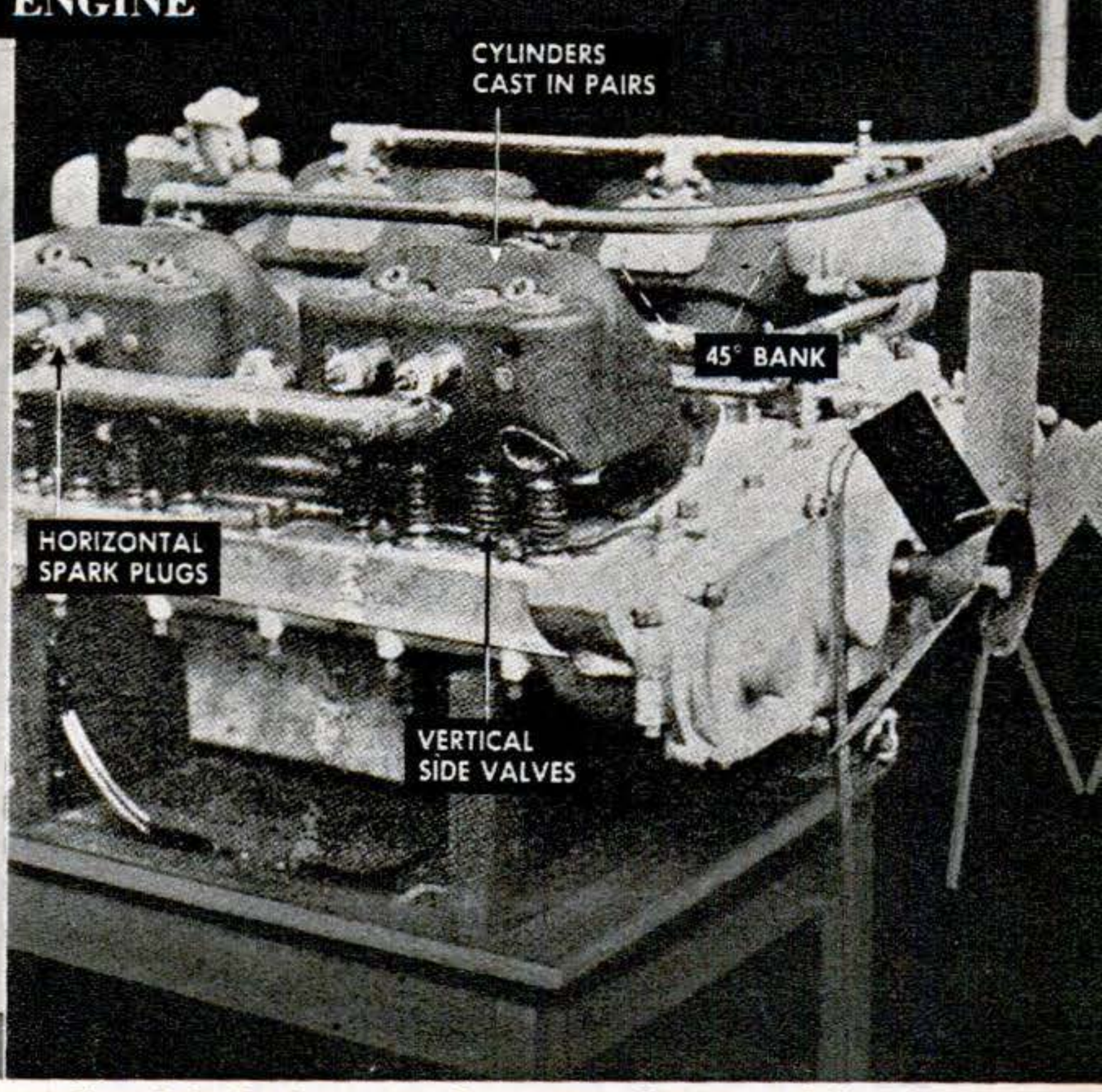


RIDING COMFORT IS ANCIENT

The J. B. West "gasoline vehicle" of 1895 combined three features without which the present-day car would be considered old-fashioned. Its rear wheels were disks "built from a web of steel plates" that could carry a ton of weight each, and carried 6¼-in. Dunlop balloon tires not much smaller than today's deep-section rubber. Further, as can be seen, the seat was wide enough for Mr. West and two women companions in voluminous clothing. West's basic ideas on comfort were not reintroduced until nearly 40 years later. At right above is today's streamlined version.

THE V-8 ENGINE





It's a fact, although not generally known, that the V-8 engine, now so popular, is 44 years old. At the 1905 London Motor Show, 10 years before Cadillac pioneered the production of this type of power unit, Rolls-Royce exhibited the 20-hp., side-valve V-8 seen at right. In basic design it differed little from the latest Ford V-8 at left. The eight cylinders were cast in pairs inclined at 45°, just as they are today. The L head permitted a vertical valve layout that made long-valve ports unnecessary. Contemporary descriptions tagged the engine "a most original design."

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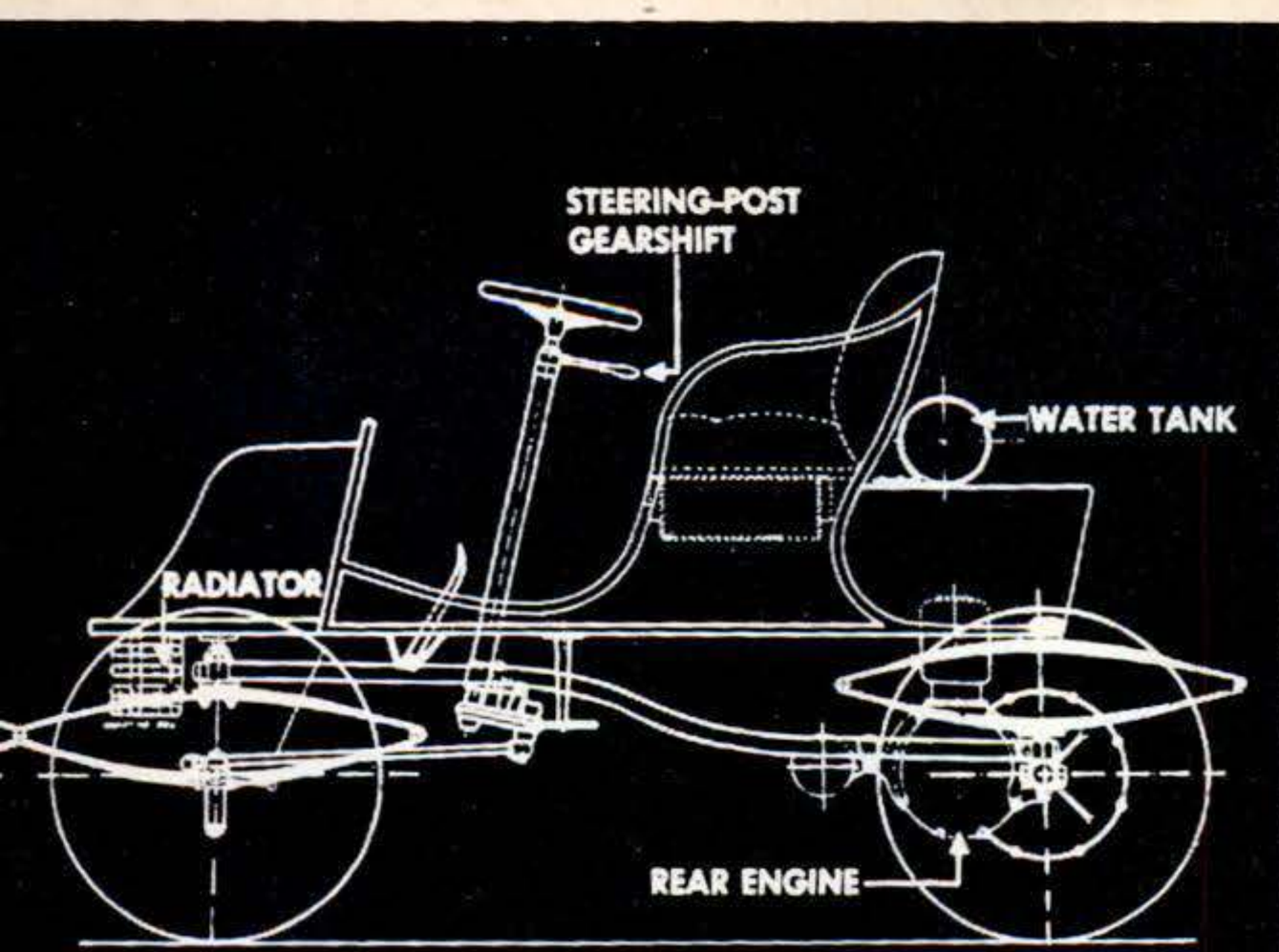
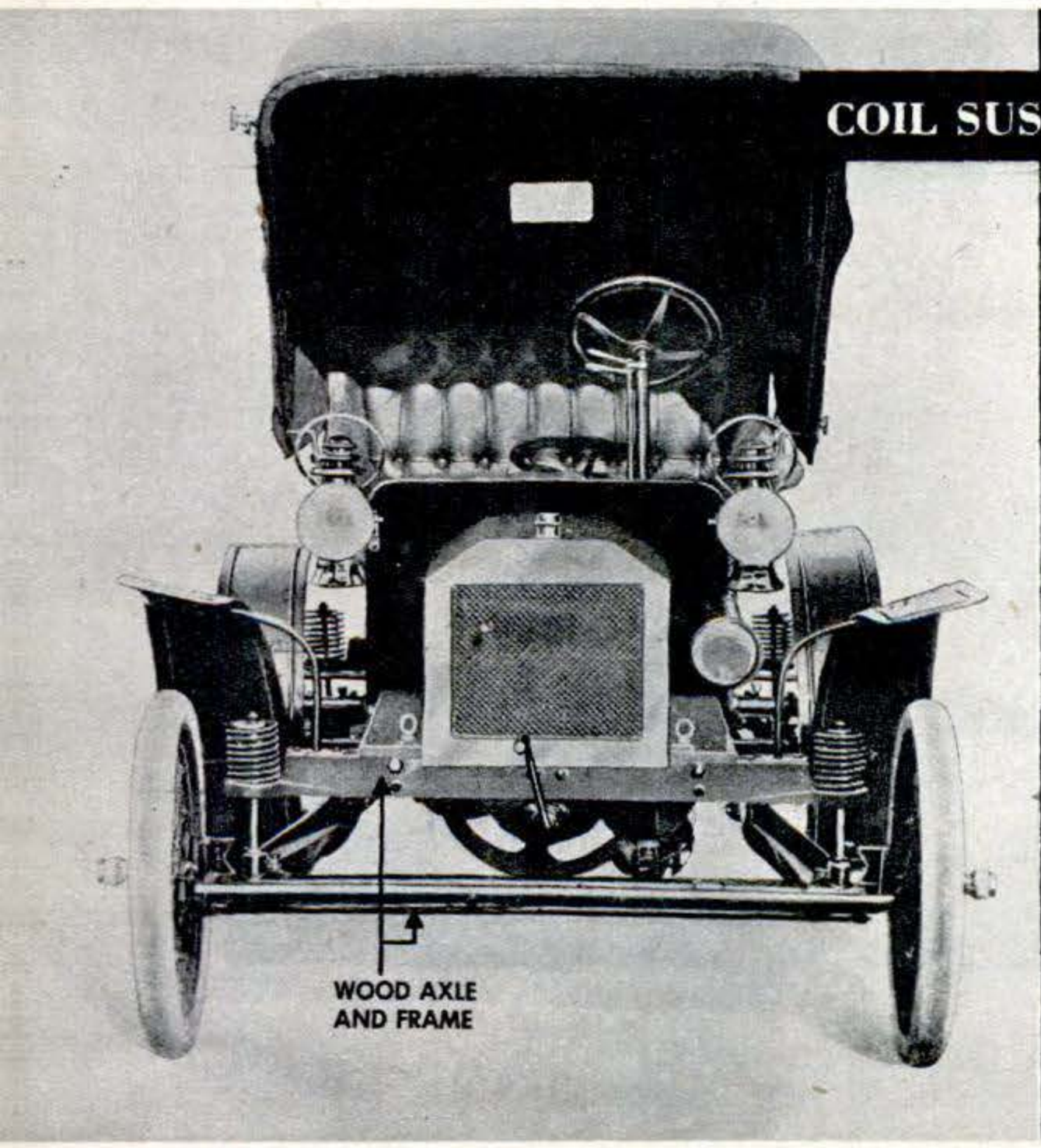
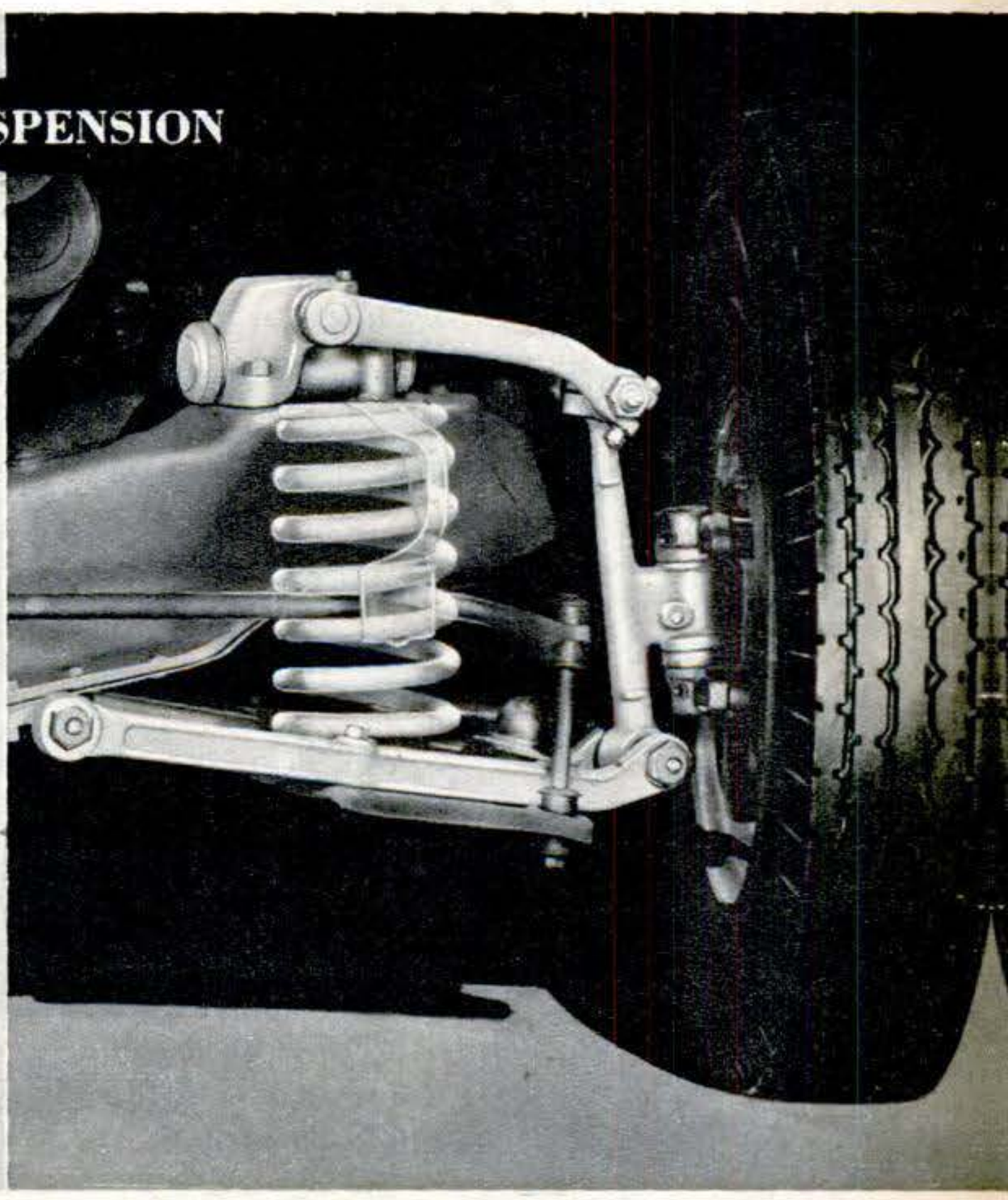


STEERING-POST GEARSHIFT

Steering-post gearshifting is literally as ancient as the automobile itself. The 1888 German Benz Velociped® first used the device. At the turn of the century it was a production feature of several American cars. The 1905 Pierce Stanhope Motorette®, left above, used a notched quadrant, but the mechanism was *inside* the steering-post. Said the catalogue: "The gear lever being directly under the operator's hand, it is impossible to make a mistake in selecting the required speed." Remember the fuss when this gearshift came back in 1938? Also note rear-mounted engine.

COIL SUSPENSION





Here's another "modern" feature rediscovered in 1934 and hailed as a radical departure from the old leaf-type carriage spring. But coil suspension already was ancient 15 years ago. The 1907 Brush Runabout had coil springs *on all four wheels.* Even today this feature appears on only a few cars. True, the Brush suspension was not independent; it used wood axles treated in oil, but that was mainly because metallurgy had not caught up with design. Another Brush feature, a counterbalanced crankshaft, enabled the single-cylinder engine to operate at 2,200 r.p.m.

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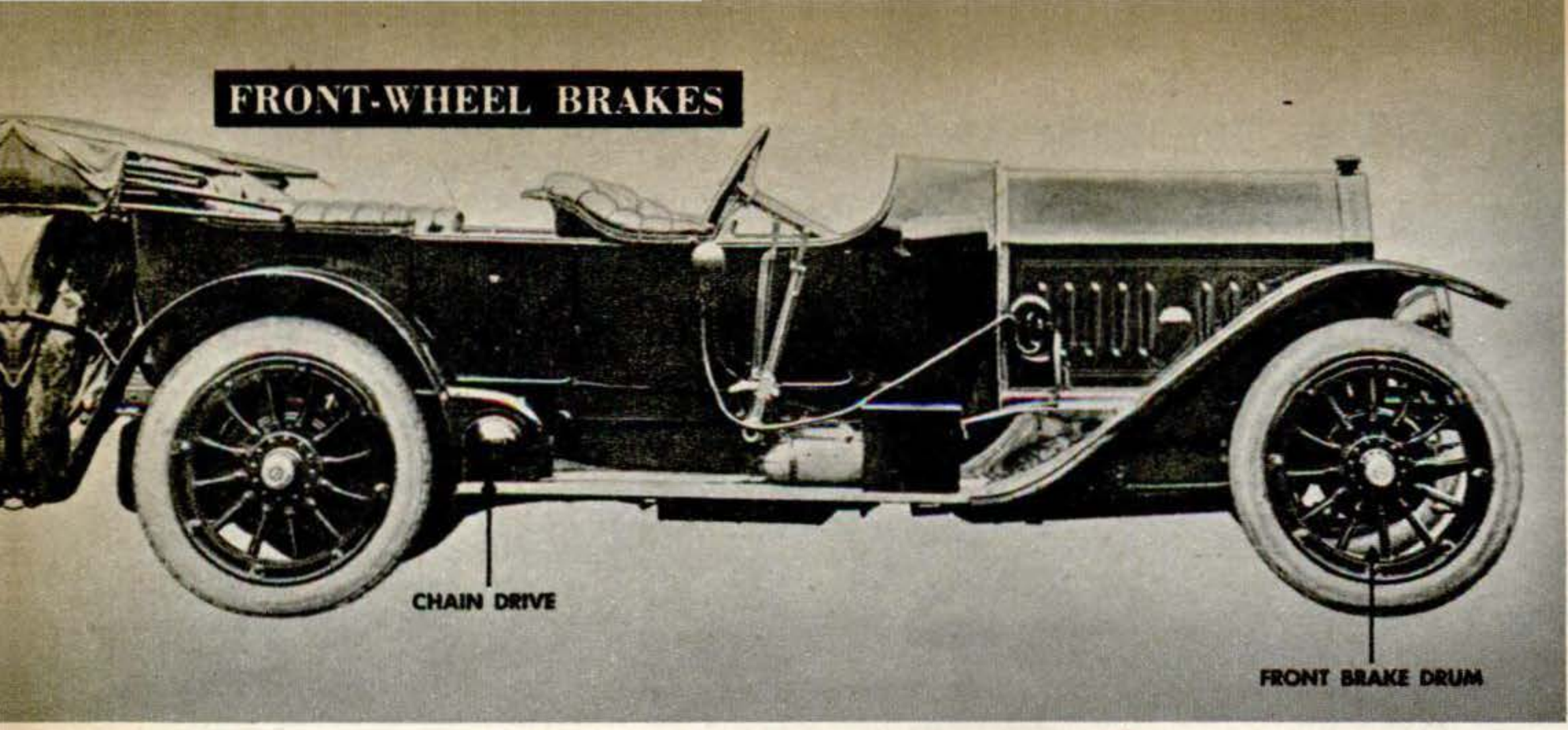
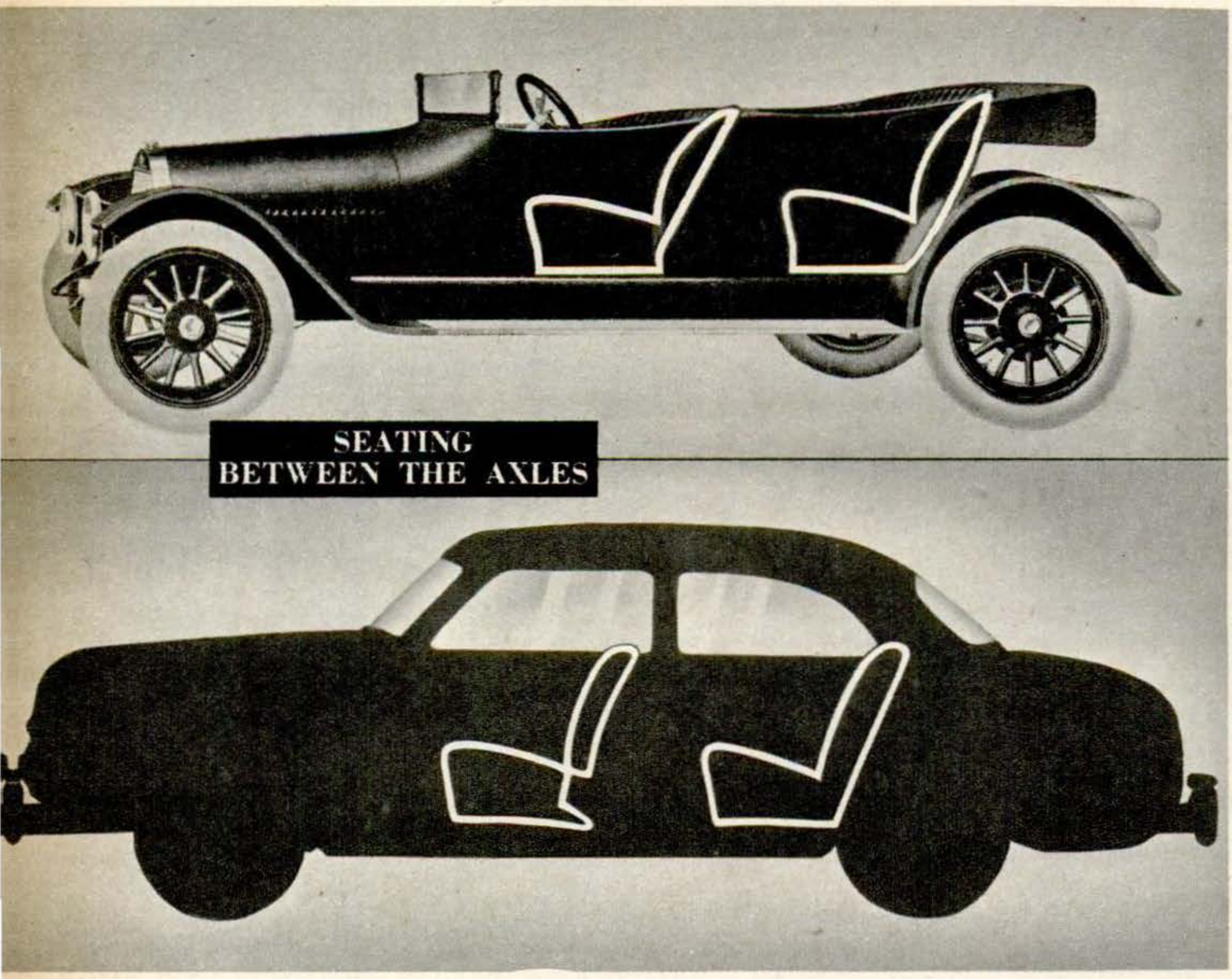


The 1910 Isotta Fraschini, an Italian luxury car, used front-wheel brakes 39 years ago. But even then they were far from new. P. L. Renouf took out English patents for a cable-operated system back in 1904, although technical bugs ruled it out. By 1913, four-wheel brakes had disappeared entirely, and they did not return until the middle twenties. The Isotta had three sets of brakes: two separate foot pedals worked the rear-wheel and differential (water-cooled) brakes, while cable-operated front-wheel brakes were independently applied by a hand lever.



What's so new about wide bodies and between-the-wheels passenger ride? An "innovation" of the thirties, it was featured on production models of the American Austin, top, back in 1914—just 35 years ago. This fine car had a 141-in. wheel base. "We want you particularly to note," said the catalogue, "the advantages of this close-coupled body where all passengers are placed far forward of the rear axle, and in the most desirable position for riding. There is ample room for three passengers on both front and rear seats." Now look at the latest Ford, above.

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Magnet Holds Hangers

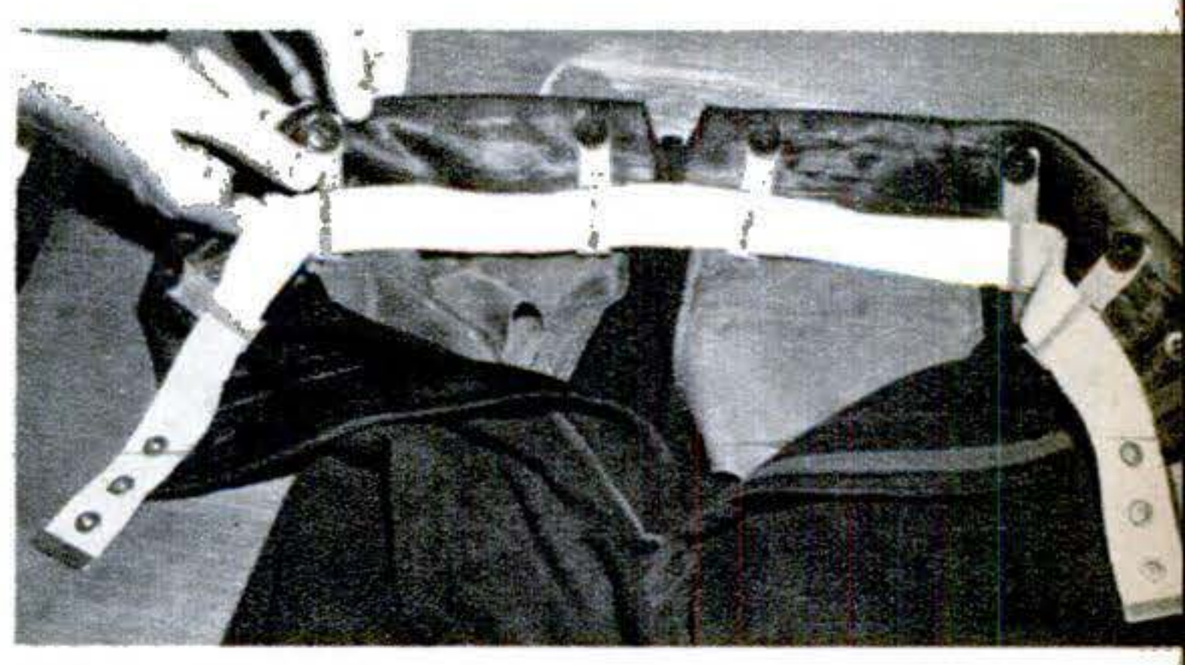
CUSTOMERS in a New York manufacturer's showroom think the salesgirl is careless when she casually slaps a clothes hanger against a wall with no hooks. Then they gasp when the metal hanger stays suspended there! The secret is a magnetic core a few inches wide and several feet long built into the wall itself and covered with wallboard and wallpaper.

New Welder Cuts Static

WELDERS don't ordinarily listen to the radio while working—too much static. But they can now, as shown above, if using GE's new balanced-wave inert-arc welding machine. This welder balances out unnecessary parts of the welding current, sustaining the arc without causing the high-frequency radio signals that interfere with radio reception.

Belt Fits Inside Trousers

Now you can make your friends wonder what holds your pants up. The gimmick is a new belt (right) designed to be worn inside the waistband of your trousers. Six plastic stays that attach to the suspender buttons and three sets of snaps, replacing the buckle, adjust it to size. Made of cotton and rayon web, the Invisibelt® also keeps your shirt from riding up. The belt sells for $2.50.



Television Rides Wires

THE television camera and receiver shown below work without radio waves. They were designed to keep an eye on dangerous industrial processes or bring a close-up of demonstrations and surgical operations to large groups of students. The system, called Vericon®, operates entirely on wires and requires no government permit.

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Pictured above and at the top of the opposite page are a real kitchen and its scale model.

Miniature Mock-Ups

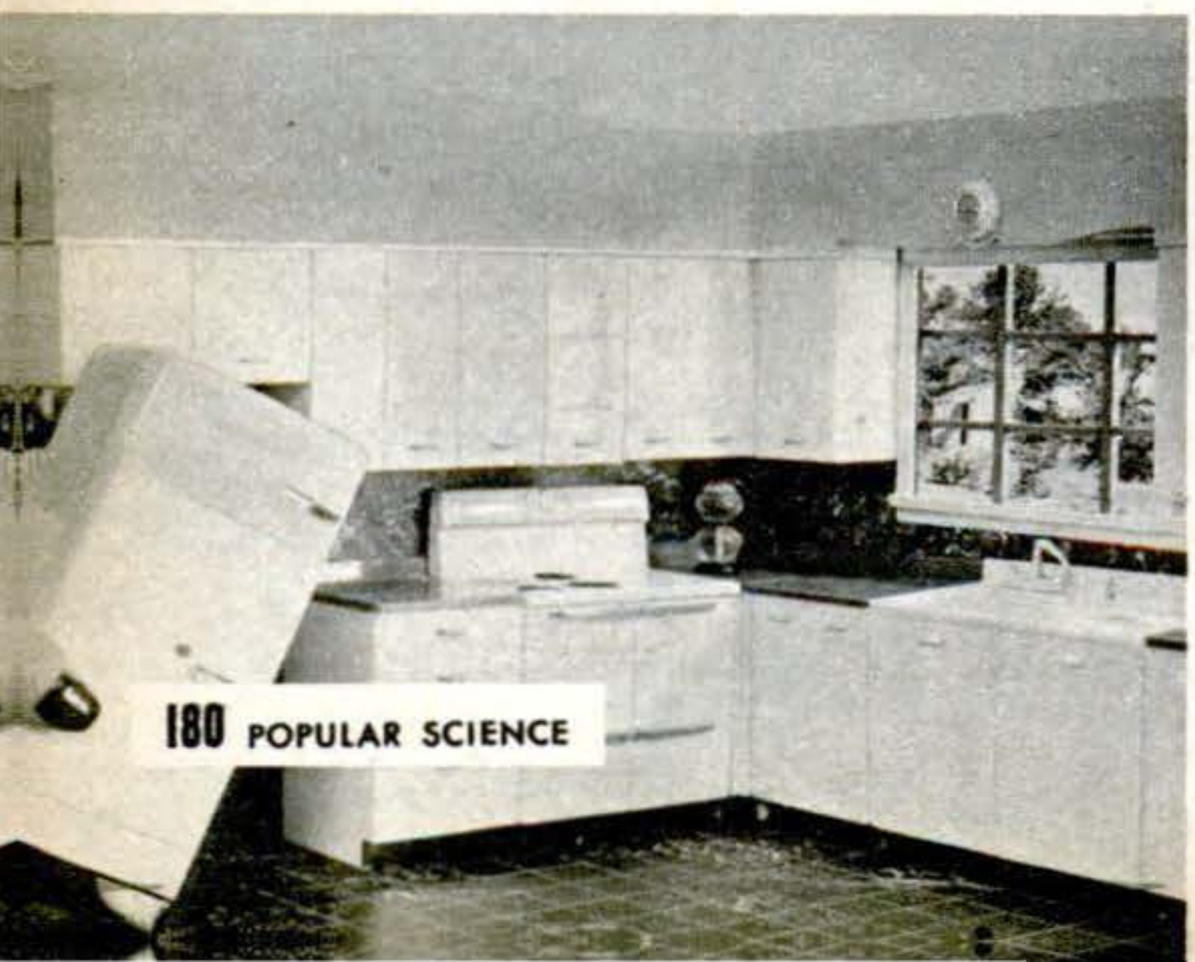
PS photos by W. W. Morris

TINY plastic furniture and scale models of electrical appliances now let you see in advance what a remodeled kitchen will look like.

To see how lifelike they are, look at the two pictures at the top of these pages. Can you tell which photograph shows a real kitchen and which its miniature model? (The full-size kitchen is the one pictured on the next page.)

A kit recently put out by General Electric, called Applianset®, contains more than 75 replicas of standard GE kitchen equipment, scaled one inch to the foot: electric ranges

Scale-model furniture is arranged (below) according to a kitchen-remodeling plan submitted to GE's Home Bureau. Magnets in clock and hanging cabinets hold them to model's metal walls.



Photographer then snaps picture of the miniature kitchen in studio. Photo will be forwarded to the homeowner so that he can see in advance the exact results of his plan for remodeling.

Which of the photographs shows the full-size kitchen? Check your answer with story below.

Preview Remodeling Jobs

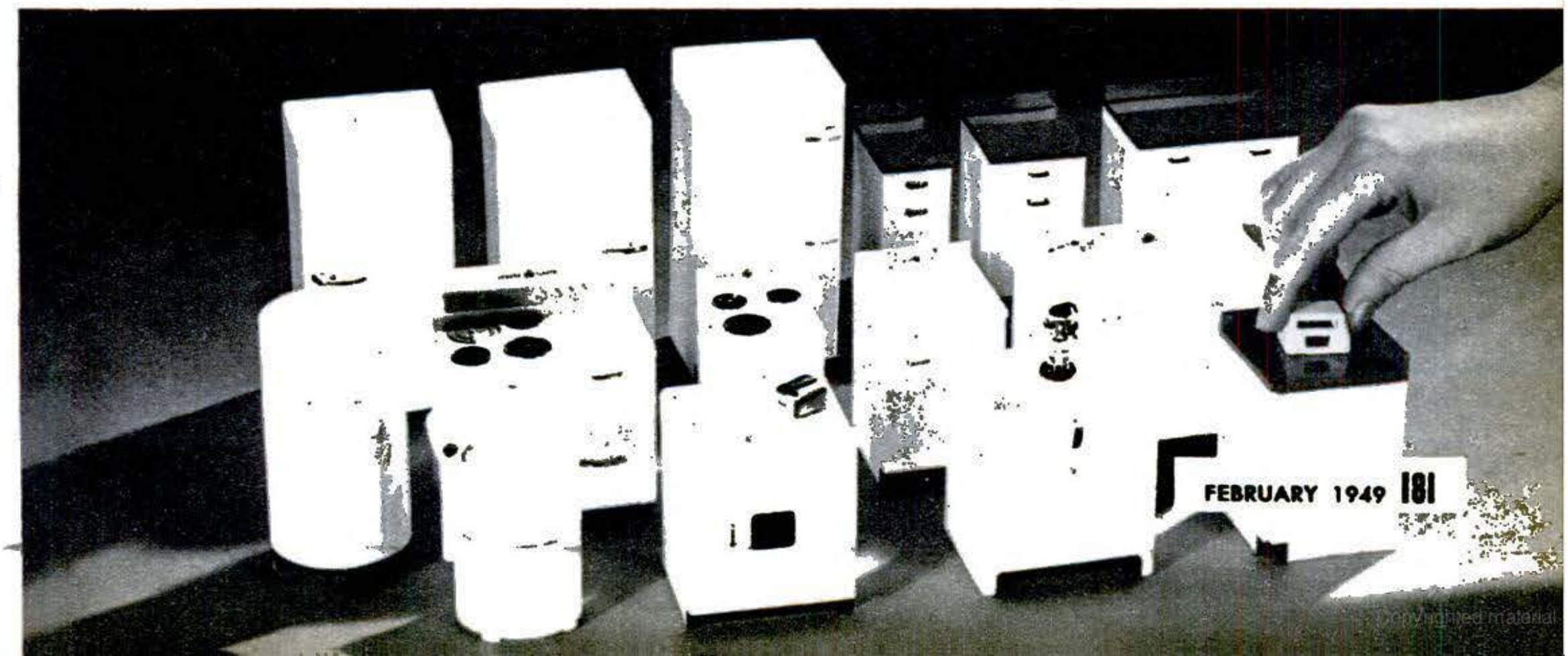
and refrigerators, electric sink, cabinets, home freezer, toaster, coffee maker—even a table radio and a wall clock.

Four metal walls, 16 in. long and 8½ in. high, are stamped with measurements to help a planner copy almost any room exactly to scale. There are also four windows, in two sizes, and both interior and exterior doors.

Appliances in the kitchen shown at the top of these pages include a six-foot refrigerator with a separate freezing compartment at the top, a push-button stove with two ovens, and a combination sink and dishwasher.

GE designed the models for use by architects, home planners, home-economics teachers, and store-display designers. END

Variety of equipment in model-kitchen kit is suggested by photograph below, showing 19 of its 80-odd pieces. Two of the refrigerators have doors that open from the right; one (and another not shown) open from the left. In front row are appliances for furnishing laundries or kitchen-laundry combinations. The hand holding the table radio shows the comparative size of the models.



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Oil Fire Made to Order

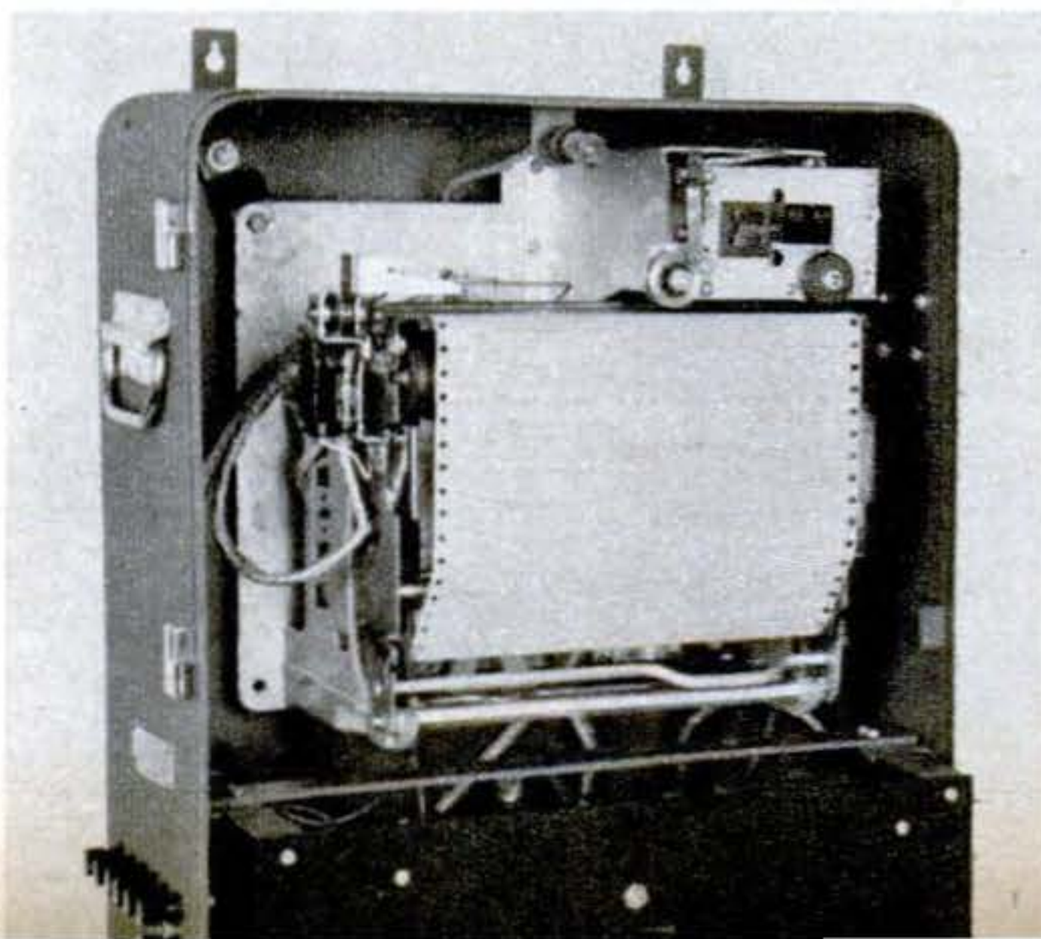
WHEN the movie *Tulsa* called for an oil-well fire, its producers sent for John Fulton, special-effects expert. The results of his handiwork are shown above. On a space no larger than a city block, he built 100 baby derricks 16 feet high, 24 dummy storage tanks, and a dozen model buildings. Dynamite bombs provided realistic explosions, while sprayed gasoline supplied the roaring flames. Dramatic close-ups were made by pushing an asbestos-wrapped camera into the inferno with a long pole. Cost: $65,000.

Small Saw Has Big Bite

GIANTS of the forest up to 5 feet thick fall quickly under this lightweight, one- or two-man chain saw. A 5-hp. gas engine drives the toothed chain, which both rips and crosscuts, around a blade. Handle-bar grips permit easy holding, while the swiveled blade cuts at any angle. For two-man use, as shown below, a handle with a dual throttle attaches quickly to the blade's tip. Made by McCulloch Motors, the entire unit weighs only 45 pounds with a 20-inch blade. Longer blades come in 3-, 4-, and 5-foot lengths.

Army Gets "Weathermen"

ARMY weathermen can set up this portable "electric weatherman" in the field and then go off and forget about it for a month. When they come back, they have a continuous, 800-hour record of wind velocity and direction. Moving arms connected to a wind-speed indicator and a weather vane trace wavy lines on a moving roll of paper. Instead of using ink, the arms mark the paper by sending sparks through it. Made by GE for the Signal Corps, the device can register wind speed up to 150 m.p.h. and direction to within 1½°.



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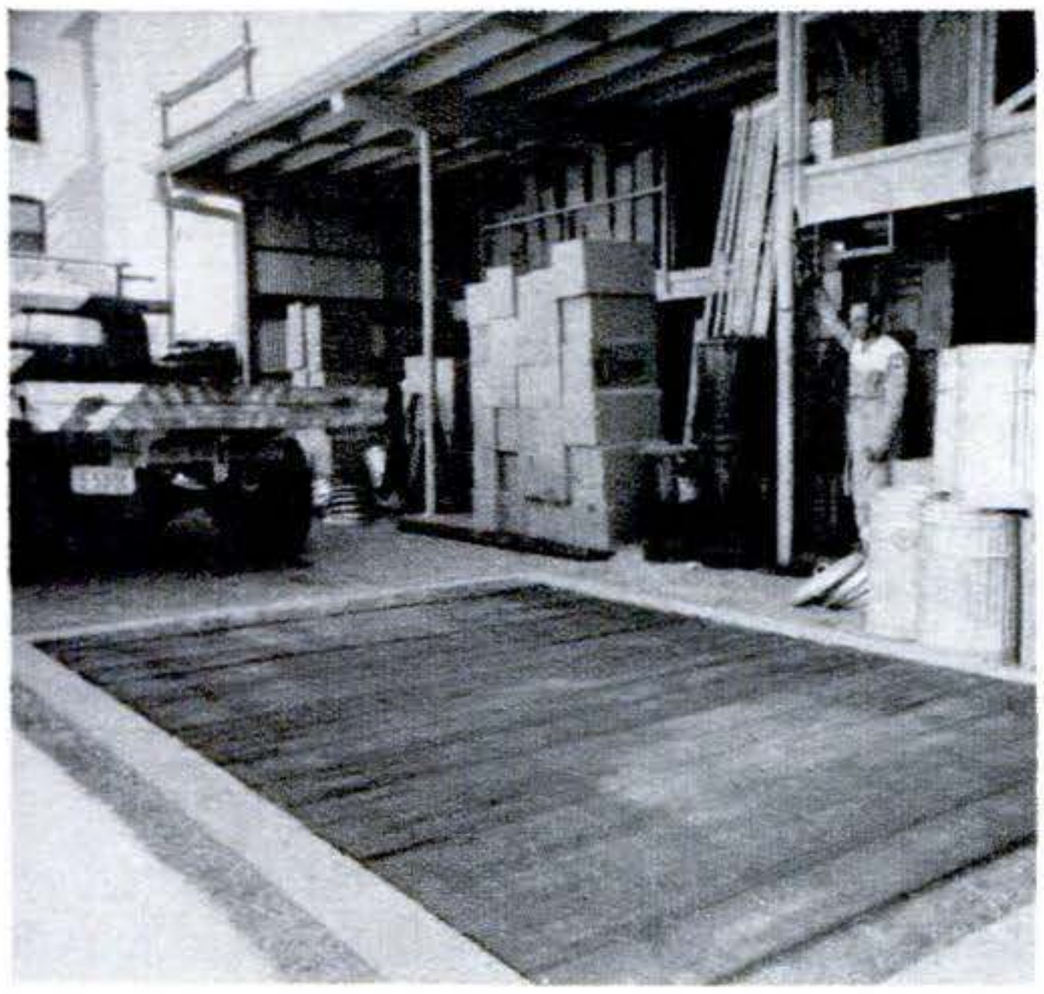
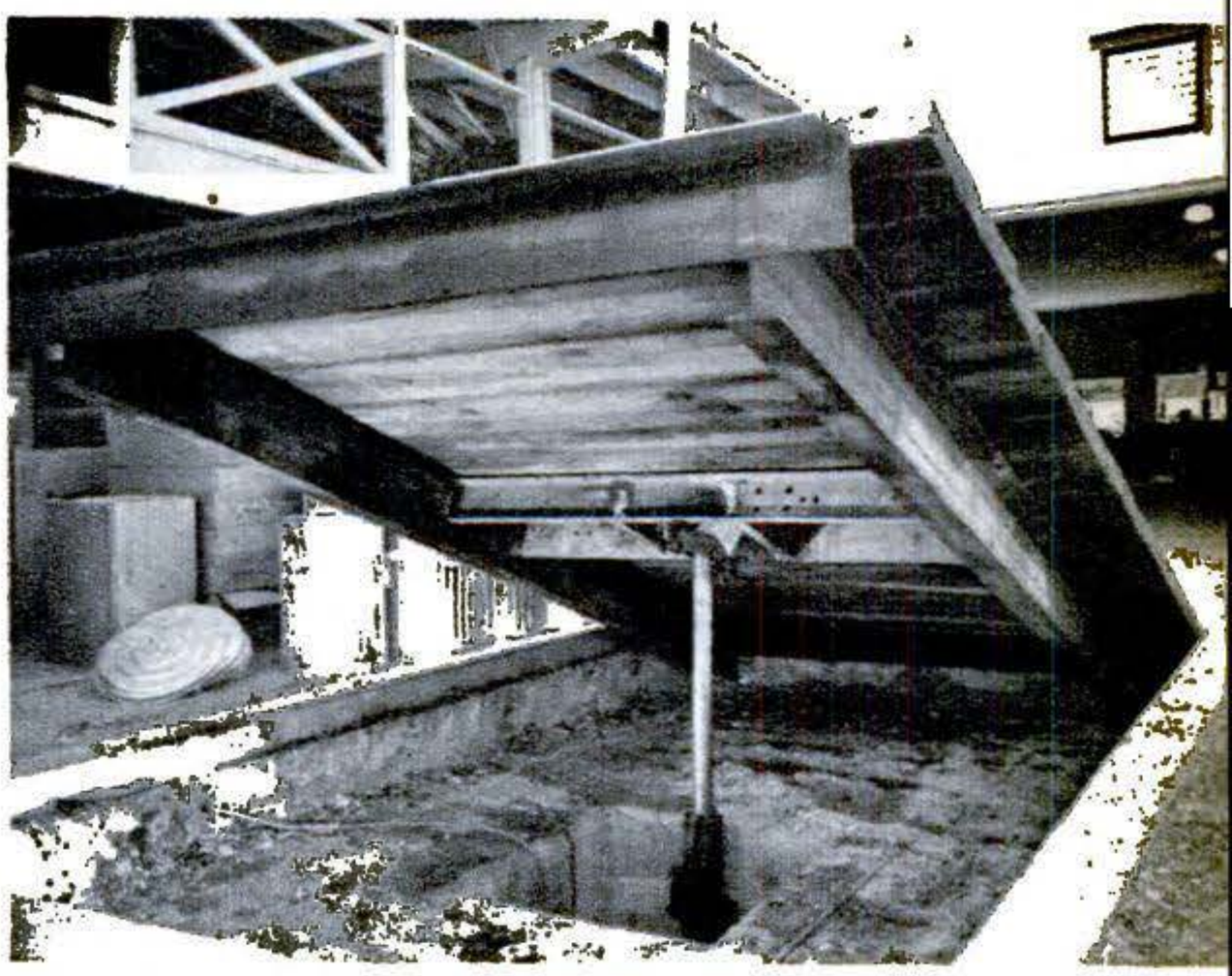
Case of the Vanishing Ramp

WHEN the F. Ronstadt Hardware store in Tucson recently decided to install a loading ramp, its proprietors discovered they had no place to put one. The small, cramped loading area in back of the store just wasn't big enough for a large, permanent ramp.

Then J. W. Briscoe, the store's general manager, and J. H. Lynn, service manager, put their heads together and came up with a novel solution. Out of spare parts and a little ingenuity, they devised the vanishing ramp shown below. Now they have a ramp that can be raised to any desired height when loading a truck and then lowered out of the way when the loading is finished, making room for other necessary jobs.

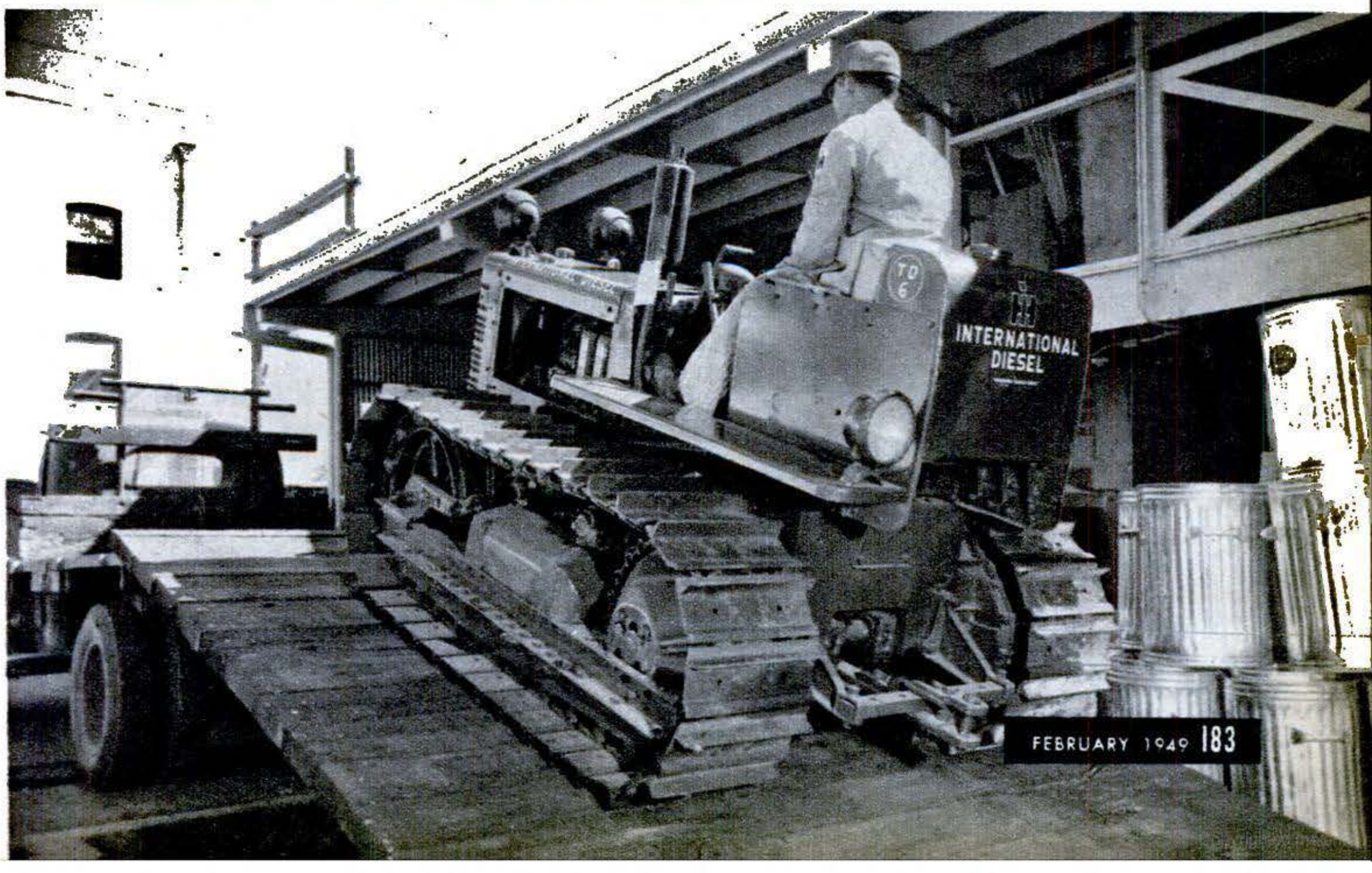


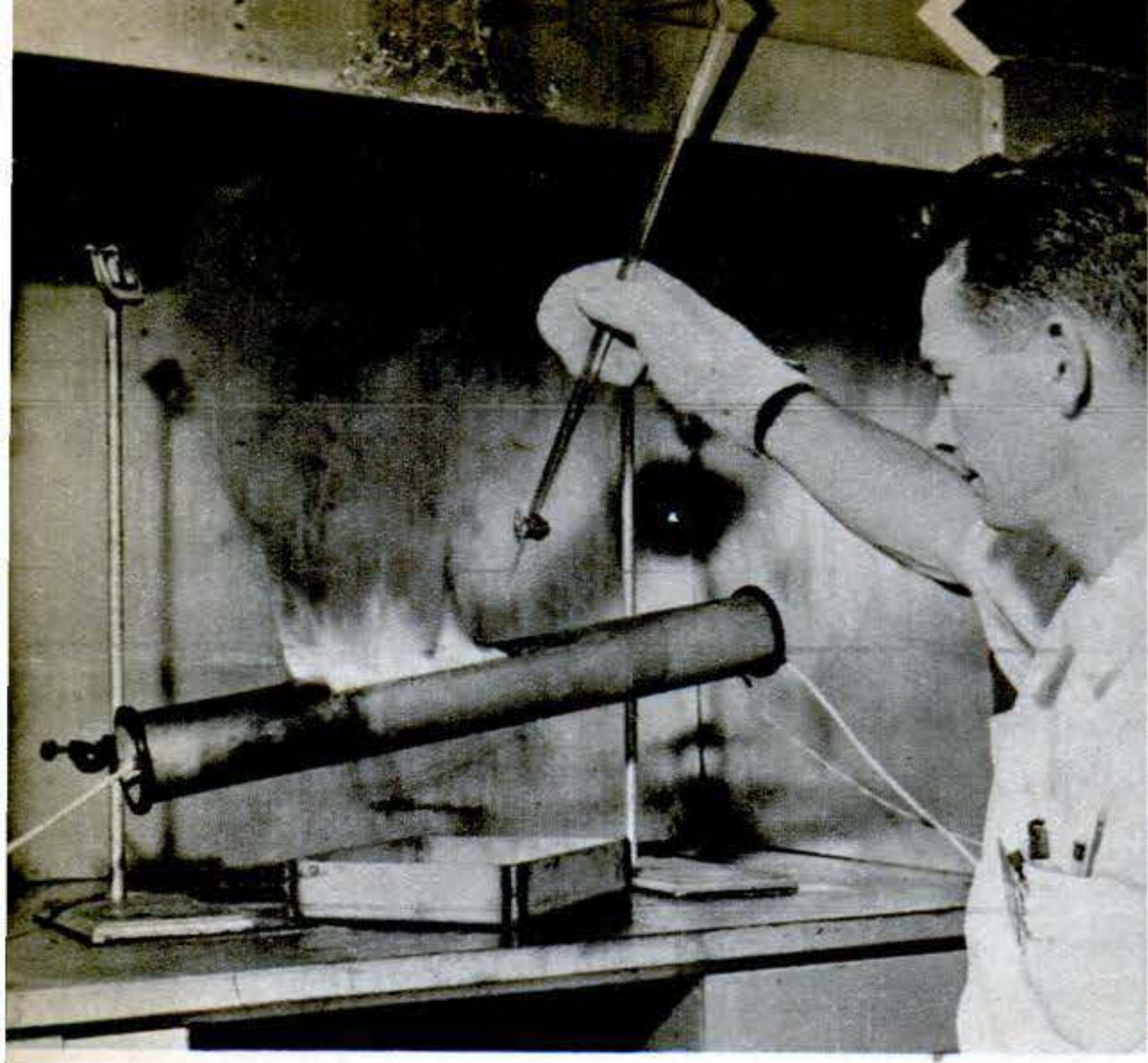
When not in use, vanishing ramp is lowered into concrete recess, flush with ground level. Made of welded, steel I-beam frame covered with heavy planking, it is 9 ft. wide, 14 ft. long.

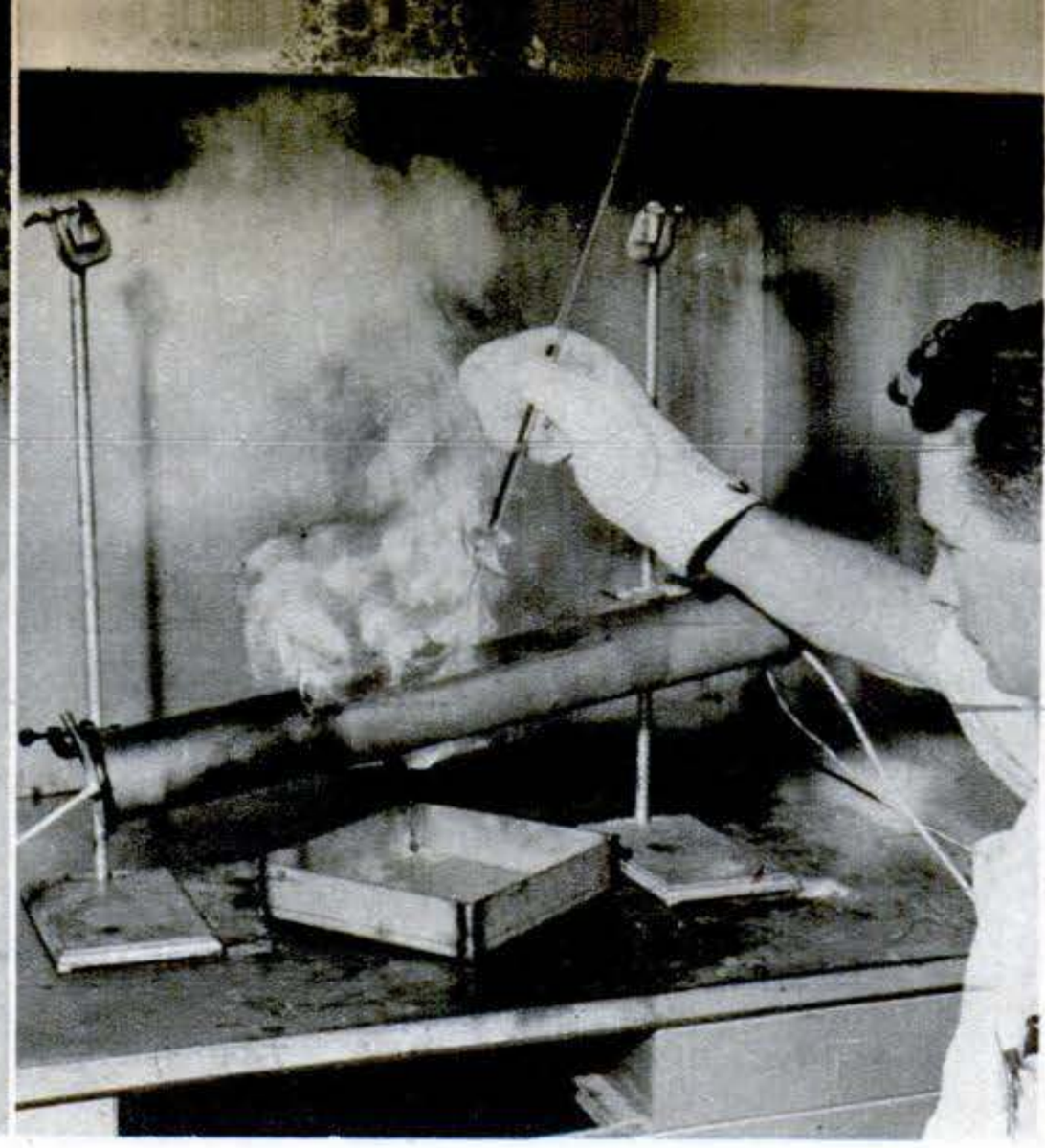


Hinged ramp is raised by hydraulic dump-truck lift, powered by war-surplus gear pump and sunk in pit. Simple hinge is two pipes, one turning inside other; one fastened to ramp, other to ground.

By itself, ramp will support 3 tons; with upper end resting on truck, 14 tons. Tractor below weighs nearly 18 tons, but ramp's I beams run directly under its treads, supporting the weight.







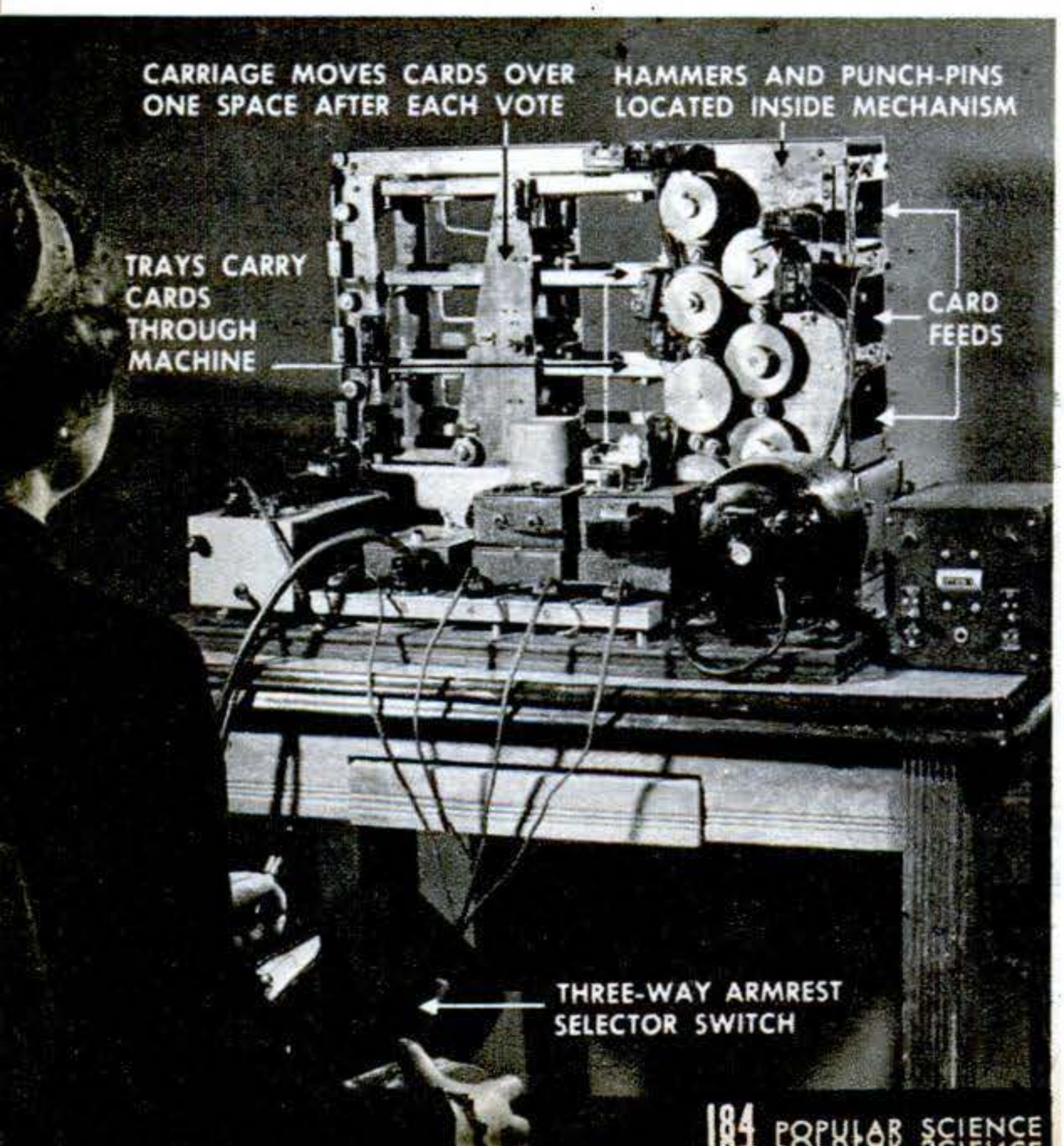
New Hydraulic Fluid Is Not Fuel for Fires

MORE than one tragic airplane fire has been traced to escaping hydraulic fluid ignited by short circuits or from contact with red-hot exhaust pipes. Now, as the result of two years' research by the Douglas Aircraft and Monsanto Chemical companies, along comes Skydrol®. Synthetic, an ester-base compound, it not only is fire resistant, but in recent tests actually extinguished the superhot flame of an oxyacetylene torch.

At left above, HS-1, a reference liquid, not an hydraulic fluid but a standard for non-flammability, is dropped on a stainless-steel tube heated to 1,300° F. It ignites, although no flame drips into the pan below. At right, Skydrol, dripped on the same glowing red tube, does not flame at all but simply vaporizes. In this demonstration it thus far exceeds the flammability requirements of the HS-1 reference fluid set up by the Aircraft Industry Association.

Some 78 formulas were studied in the laboratory, and 28 fluids were subjected to hydraulic-system tests, before a suitable non-petroleum-base fluid was hit on. The requirements were rigid. The fluid had to be oily to lubricate the moving parts of pumps that operate a plane's hydraulic system. It had to be non-corrosive to avoid deterioration of metals with which it comes in contact. It could not thicken at low temperatures or thin out at high temperatures.

Another feature of Skydrol is that it even extends the life of pumps and other working parts of the hydraulic system. But above all: *it does not feed a fire!*



Machine Polls Audience

WHAT did the studio audience think of that radio comedian's last gag? Here's a machine that gets answers to such questions right from the audience itself. The device, in its present form, lets three people vote for, against, or neutral by simply flipping a three-way switch on the arms of their seats.

The machine, invented by engineer Paul Schwerin, holds a card for each person tested. When the votes are cast, tiny hammers strike pins that punch holes in these cards, the position indicating the vote. Later, the totals are found by running the cards through a standard punch-card machine.

After each vote, a carriage pulls each card across the machine in a flat tray into position for the next vote. By simply adding trays, an entire audience could be polled.

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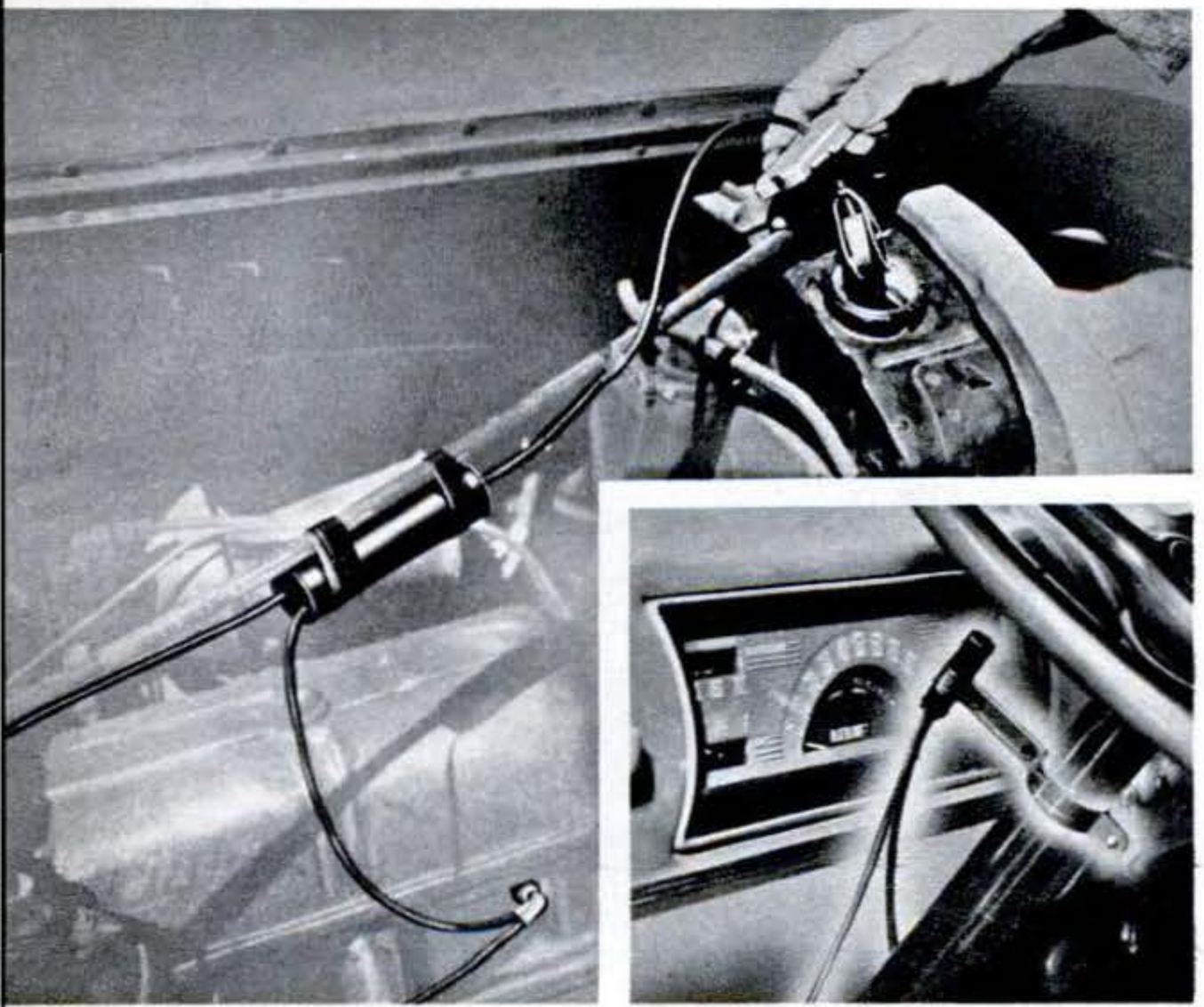
Glass That Folds Developed

To ELIMINATE the narrow rear-vision window in convertible tops, a horizontally folding window is being produced by the Pittsburgh Plate Glass Company for use in the new Hudson convertibles. Formed of a special glass-plastic sandwich, the new window folds like an accordion on a ¾" plastic-joint connection when the top is lowered.

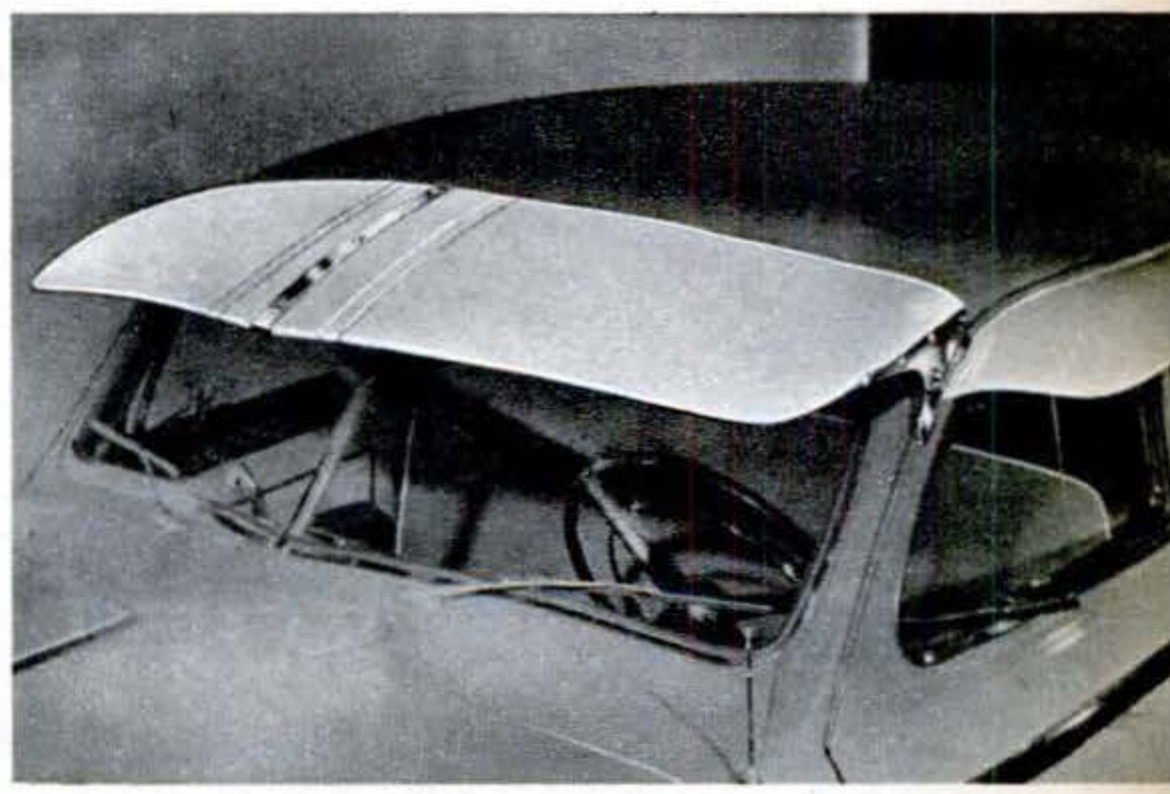


Neon Light Warns of Low Water

WHEN the radiator water drops below a probe mounted in the water below the radiator cap, a flashing neon light on the steering column warns the driver. Levelight®, made by the Lindberg Instrument Company, Berkeley, Calif., may be set at any desired level. Energy for the light is obtained from one spark plug through a clip fastener on the plug's lead. Priced at about $10, the light assembly may be installed in 15 minutes.

Truck Cab Swings Out of Way

THE USUAL method is to lift the hood when you want to get at an engine for servicing. In this case, however, you raise cab and all. The Neville cab, developed in England, is operated by an electric motor that hinges the cab forward for speedy trouble-shooting and servicing. Photo above was made at London's first post-war commercial truck show.



Sun Visors Offered in Sets

THESE side visors and matching front visor are made by AiRite Manufacturing Co., Toledo, Ohio. They are die-stamped, spray painted, and baked. The set comes finished in prime paint for optional color matching with your car. Easily installed, the visors fit most of the cars now on the road, according to the company announcement.

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RAY OWLESEY

"Gabriella," Dr. Evants said, pointing, "is experiencing some slight mechanical difficulty. The symptoms are spasmodic misfiring."

Gus and the Car That Knew When to Stop

By Martin Bunn

WHEN you've run a garage as long as Gus Wilson has, you've just naturally seen so many people reacting to so many different situations that nothing much surprises you. That's one reason Gus is so slow to make snap judgments about people or cars. But then along comes something that gives you a jolt, sort of knocks your hat off, and leaves you standing there scratching your head and wondering.

The day this happened to Gus started like any other day at the Model Garage. Stan Hicks, who's learning to be a pretty good mechanic, and Greg Jones, the grease monkey, were laughing and kidding each other as Stan began checking a generator. Gus had picked up a main-bearing job where he'd left off the evening before. Then a '35 sedan rolled into the shop.

The man who stepped out of it looked like a Hollywood version of the absent-minded professor. He wore earth-stained sneakers, baggy corduroy trousers, a checkered jacket, and a frayed shirt with wing collar but no necktie. His lined face, half hidden by an untidy gray beard, was crowned by a rumpled thatch of snow-white hair. His eyes, behind silver-rimmed spectacles, were sharp enough, but there was a dreamy look about them.

Greg Jones—he's only a kid, remember—looked up and started giggling. Gus is lenient with his helpers, but he draws the line at two things—slipshod work and bad manners. A frown from Gus squelched the giggling as he stepped forward to meet this oddly dressed old man. Gus had seen him around town and had heard about him.

"Good morning, Dr. Evants," he said.

"Know me, do you?" Jason Evants replied. "I've never seen *you* before." He looked Gus over carefully and, as though alone, spoke his thoughts. "High degree of mechanical ability. Dependable—very. Ingenious. Even a bit of imagination. Should be able to do it."

Gus smiled at the old man.

"Gabriella," Dr. Evants went on, pointing a sharp finger at the old sedan, "is experienc-

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ing some slight mechanical difficulty. The symptoms are spasmodic misfiring, which results in something less than optimum performance on ascending gradients."

"The old gal's having trouble taking the hills," Gus translated to himself. And then to Dr. Evants: "Had the car worked on?"

"No," Dr. Evants shook his head. "I took Gabriella to a repair shop in the city, but the young man I consulted lacked the mechanical, spiritual, and emotional qualifications that I demand in anyone who touches her. Now, at the suggestion of my friend, Mrs. Miller, Gabriella and I have come to you."

"Gabriella Warns Me"

Mrs. Miller, a buxom, talkative woman, goes for fads—especially if they are labeled "modern." She started with Couéism, ran through Mah Jong, modern art, and surrealism, and then heard about Dr. Evants. When he moved into a shabby little house on the edge of our town, she took up both him and his highly peculiar ideas. More than once, when bringing her abused car in for repairs, she had given Gus a sample of her gushing enthusiasm for Dr. Evants.

"Mrs. Miller has told me about your philosophy of . . . er . . . ," Gus began.

"My philosophy of Universal Sentiency," Dr. Evants helped him out. "Possibly you have read my book of that title?"

"I'm afraid it would be way over my head."

"You underestimate your percipience," Dr. Evants smiled. "There is nothing in my philosophy of Universal Sentiency that is at all difficult for anyone of average intelligence to understand. Why, even Mrs. Miller—but, as I was saying, my philosophy is founded on the easily proved fact that everything in the universe is sentient. That is, that all inanimate objects have feelings and intelligences of their own."

"You mean," Gus interrupted, "that rocks and trees can think?"

"Not only rocks and trees," said Dr. Evants, "but everything. The cars here in your shop, the pipe you are smoking, the tobacco burning in it, this concrete floor—all think and feel. The more complex objects, after they have been in close contact with a particular human being, acquire some of the mental characteristics of their owner. Gabriella, for example, has as warm an affection for me as I have for her. She always warns me . . ."

Stan Hicks, who had edged up behind Gus to listen, snickered loudly. Gus brought the heel of his shoe down on Stan's foot, changing the snicker to an "ouch."

"Sorry, Stan," Gus said. "Get me the compressometer, will you?"

As Stan limped away, Dr. Evants looked after him. "As I was saying," he continued, "Gabriella always warns me of approaching disaster or trouble. She has her own ways of doing it, and it is because I have learned her ways that I am what the unthinking call 'alive' today."

"Warns you?" Gus said. "How?"

"She has her ways," Dr. Evants calmly repeated. "Do you wish to examine her?"

"Huh?—Oh, yes," Gus stammered, trying to collect his thoughts. "Misfires sometimes, you say, and hasn't any pep on hills. Let's check the compression."

The compressometer quickly told him that there was a compression leak in each of the old sedan's cylinders but that the leakage was much greater in one of them. After testing this cylinder a second time, Gus poured in a spoonful of heavy oil and tried again.

"Valve leak," he told Dr. Evants. "The oil temporarily seals leakage past the piston rings, so if that had been the trouble the compression would have been higher with the oil than without it. I'll have to grind the valves."

"That will be quite satisfactory—provided *you* do the work," Dr. Evants agreed. "Gabriella is an old and valued friend. Nothing is too good for her."

"I'll take the best care of the old gal," Gus promised. "If I come across anything else that needs to be fixed . . ."

"Don't touch it!" The old man's voice boomed out explosively. "Don't dare touch it."

"All right, but why not?" Gus inquired.

Dr. Evants shook his head stubbornly. "Gabriella is as intelligent as you are—yes, even as intelligent as I am. With the exception of the valve grinding I have authorized, leave her exactly as she is. Tampering might disrupt the method she has evolved of warning me of the approach of danger or difficulty. Leave her alone."

"Okay," Gus shrugged, "she's your baby. But tell me, how does she warn you?"

The Car That Stopped

"Gabriella has absorbed much of my own perspicacity," Dr. Evants said seriously. "She knows when danger is near, and she refuses to budge when she knows that it would endanger me."

"What do you mean?" Gus asked.

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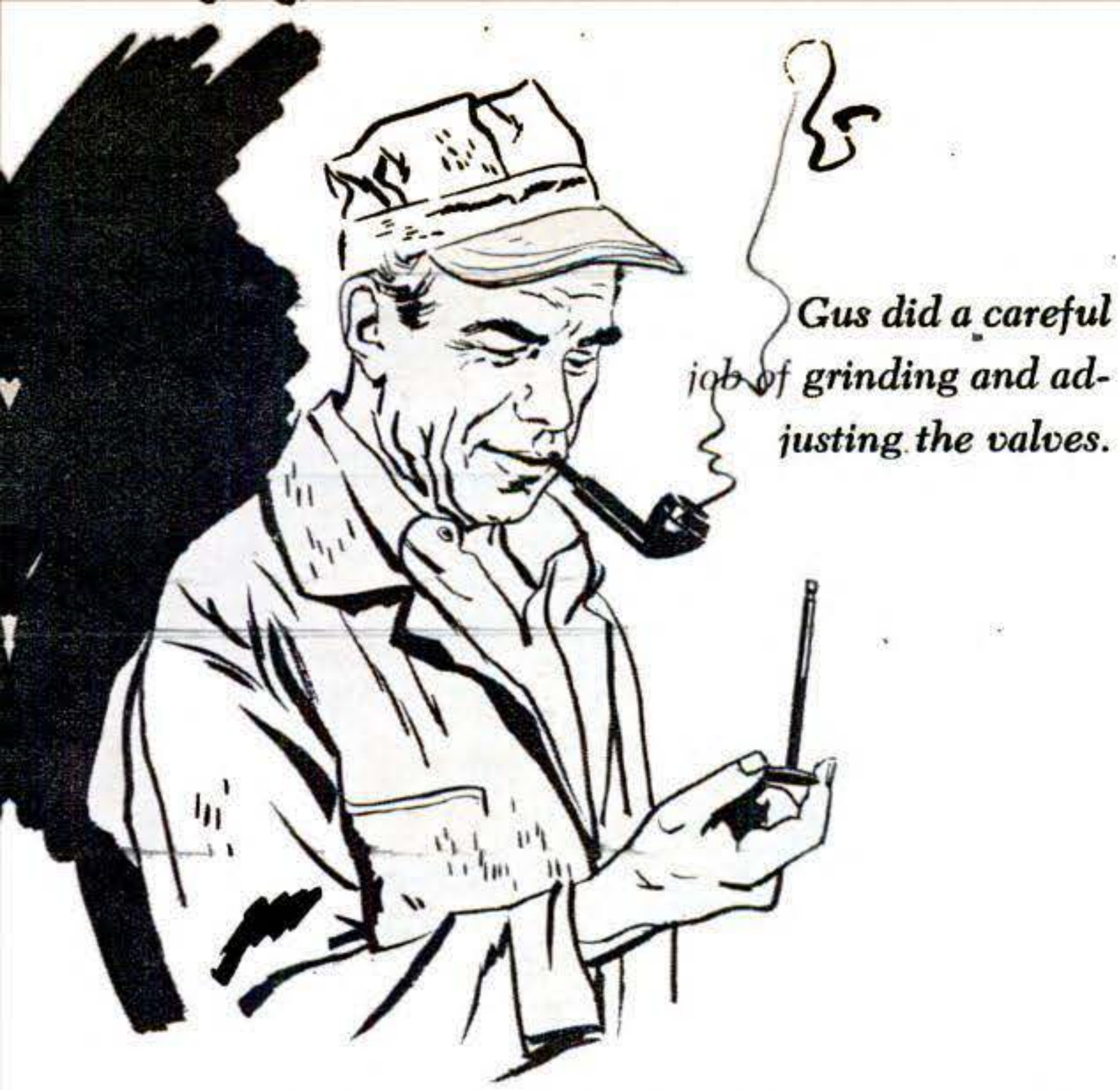

Gus did a careful job of grinding and adjusting the valves.

"Well, one dark night I was driving along an unfamiliar country road. Without warning, Gabriella stopped. While I was attempting to restart her engine, a whistle shrieked and a fast train thundered over a blind crossing not five yards ahead of us."

"You mean she knew that train was coming and stopped just in time?"

"Correct," Dr. Evants said. "If Gabriella hadn't stopped when she did, the train would have struck us. On another occasion I was about to leave home for the day. When I pressed the starter button, the engine refused to start."

"What was it that time?" Gus asked.

"I told myself that Gabriella knows best and gave up my plans for the day. I went back in the house and out on the veranda to look at my white mice. My relaxation from the rigors of philosophical thinking is the study of heredity. Imagine my consternation when I discovered that I had left the cage open! My gratitude to Gabriella was unbounded for sending me back before more than a few had escaped. There have been many similar occurrences. So leave Gabriella alone. Don't touch anything but the valves." The old man turned and strode from the shop.

Gus Disobeys an Order

After Gus had ground and adjusted the valves of the old sedan, he climbed in and stepped on the starter. Nothing happened.

"Hey, boss," Stan called, "you better duck. The old jalopy's warning you now."

"Darned if I don't believe she is," Gus laughed. He tried the starter again, this time watching the instrument panel. When he took his foot off the button he noticed that even though the switch was on, the ammeter did not register. He decided the switch was causing the trouble. When he disassembled it, he found both of the contacts badly burned and the rotating switch parts loose. When they slipped enough to let the burned parts touch, the circuit opened and the engine wouldn't start, or stopped if it had been running.

If that had happened while the car was on that railroad crossing instead of just before it got there, Gus thought, old Evants wouldn't be around now. And just to keep that from happening sometime when he isn't so lucky, I'll fix it and not say anything about it.

So thinking, Gus filed the burned spots and tightened the loose parts. This time, when he stepped on the starter, the engine took off instantly.

The afternoon was unusually busy. Gus and his two helpers were up to their necks in work and the shop floor was cluttered with cars when Dr. Evants returned.

"Gabriella's been rejuvenated," Gus told the doctor.

"Excellent, excellent," the old man beamed. "What is my indebtedness to you?"

Gus told him and Dr. Evants handed him a twenty-dollar bill. Gus called Greg Jones, who was busy with an air hose, and told him to get change from the office. Dr. Evants, meanwhile, looked around doubtfully.

"I'm not certain I can maneuver Gabriella out of your shop," he said. "It's so crowded."

"Better let me," Gus offered. "I'm used to turning 'em around." Dr. Evants moved over and Gus slid into the seat. He stepped on the starter but the engine didn't fire.

"Stop! It's a warning! Gabriella knows something!" Dr. Evants cried.

Greg came running out of the office. "Gee," he said, "I heard the starter. It's a good thing you didn't move."

"Why not?" Gus asked.

For answer, Greg hustled to the rear of Dr. Evants' car and removed the air hose he had slung around the bumper when Gus had called him.

Gus whistled. "By golly, I believe you're right," he told Dr. Evants. "Gabriella does know. If I'd moved the car, I'd have ruined the hose or pulled out the air pipe." He stepped on the button again and the engine took hold immediately. Dr. Evants merely smiled.

Several days later Gus saw Gabriella parked on the street. As he passed her, he tipped his hat. END

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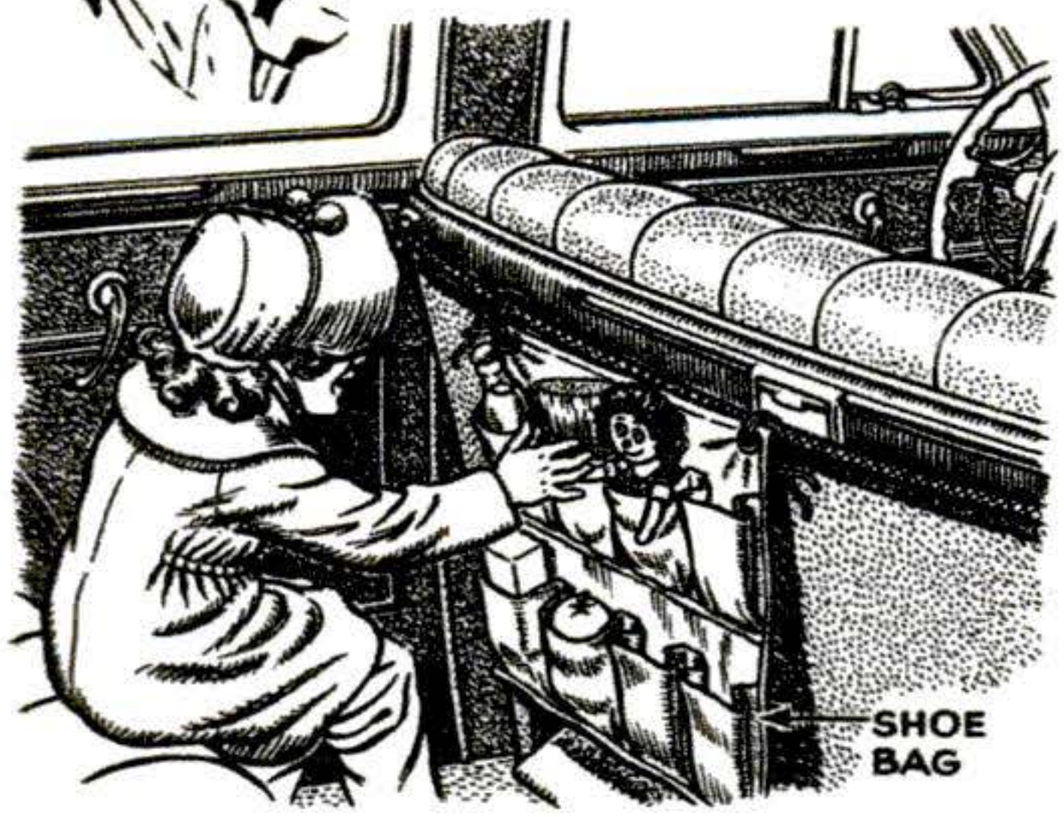
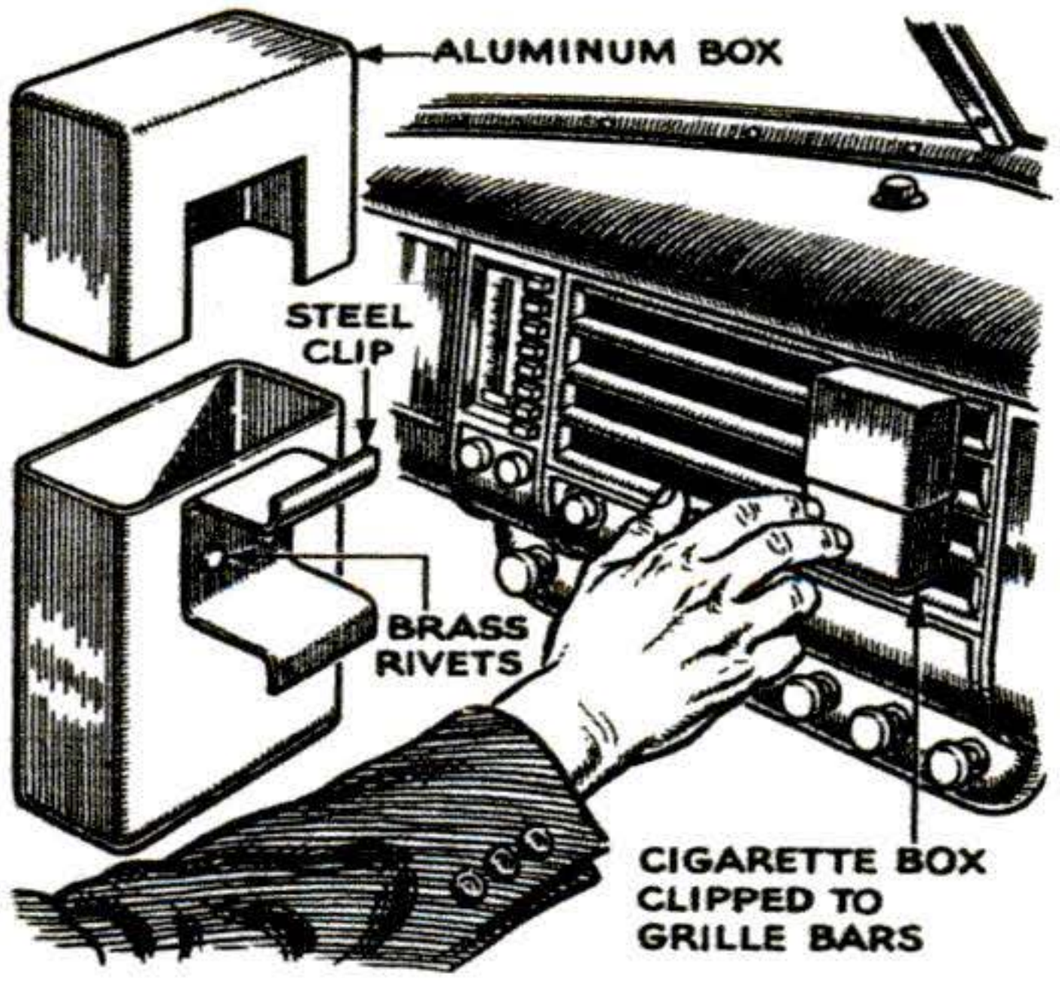
Hints from the Model Garage

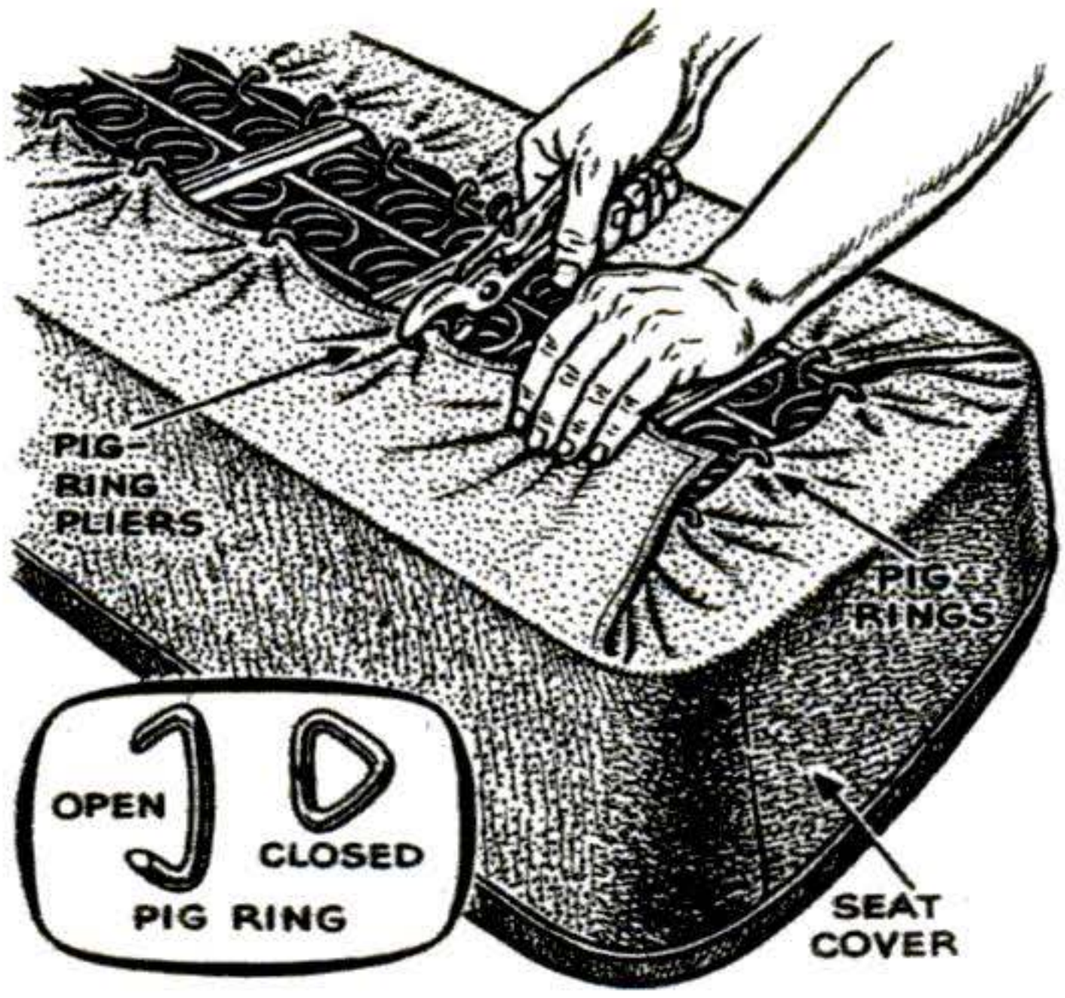


Shoe Bag Stores Toys. Before starting out on a long trip with a child, fasten a shoe bag to the back of the front seat. You can then stow toys, fruit, cookies, tissues, and other travel needs in the pockets. Besides keeping the inside of the car tidy, it saves packing and unpacking a suitcase en route.

Eraser Cleans Windshield. George A. Smith, of Quarryville, Pa., suggests that a clean blackboard eraser is a handy item to carry in your glove compartment. When moisture collects on the inside of the windshield, a few strokes with the eraser will quickly give you unobstructed vision.



Cigarettes at Your Fingertips. Here's how Claude Wiseman, Jr., of Elizabethtown, Ky., mounted an alumnium pocket cigarette case on the radio grille of his car. A clip, bent from fairly heavy sheet steel, was riveted to one side of the body of the box and the cover notched to slip down over the clip. The clip is snapped between the grille bars. For a grille with vertical bars, the clip could be rotated 90 deg.



Pig Rings Fasten Seat Cover. There are many ways that you might attach seat covers to keep them from wrinkling, but C. F. Bigwood, of Malta, Mont., comes up with one that looks especially convenient for motorists who live in rural areas. He recommends the use of pig rings to clip the cover to the springs. With a pair of hog pliers, a handful of rings can be quickly locked in place around the edge of the cover.

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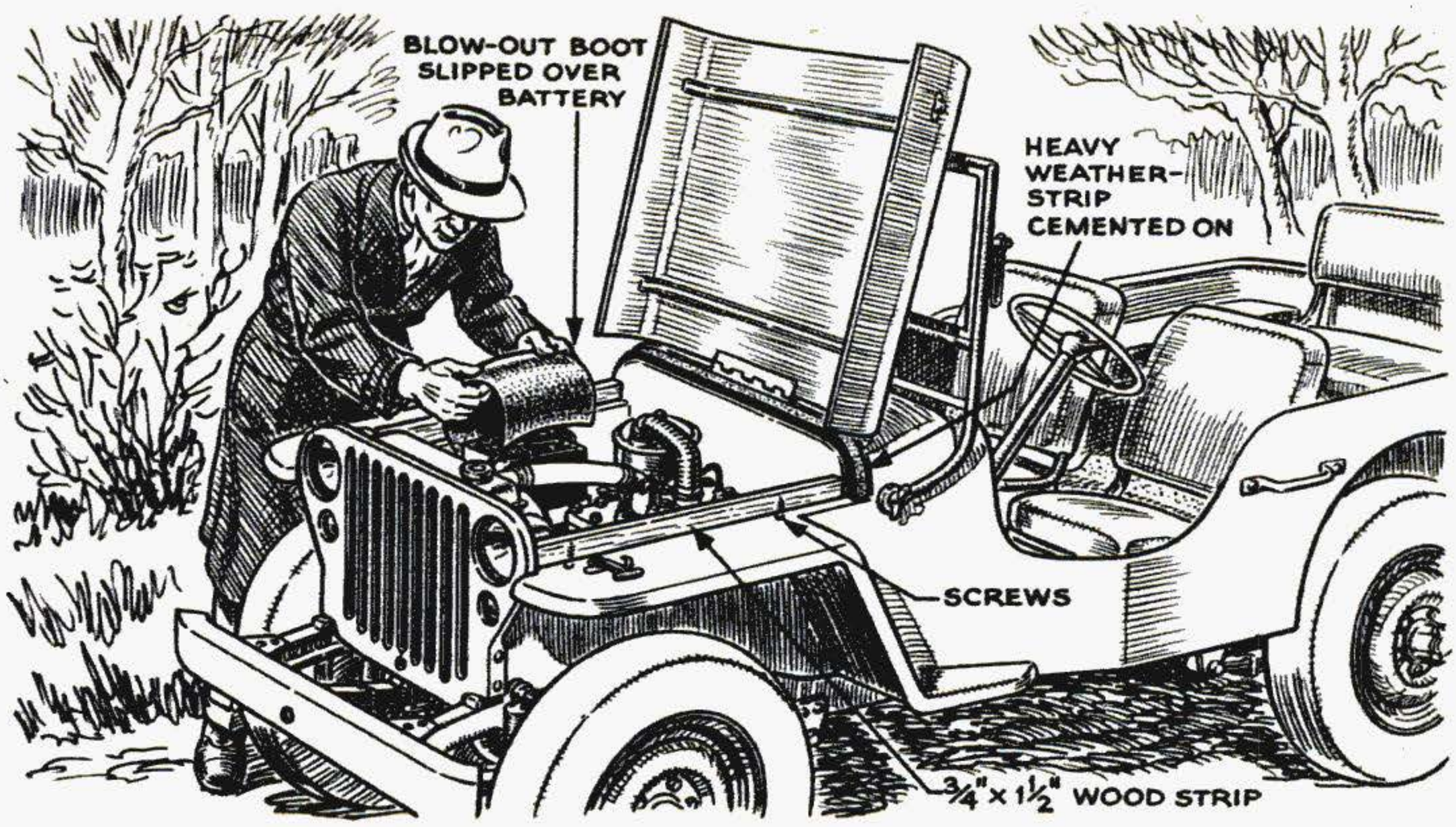
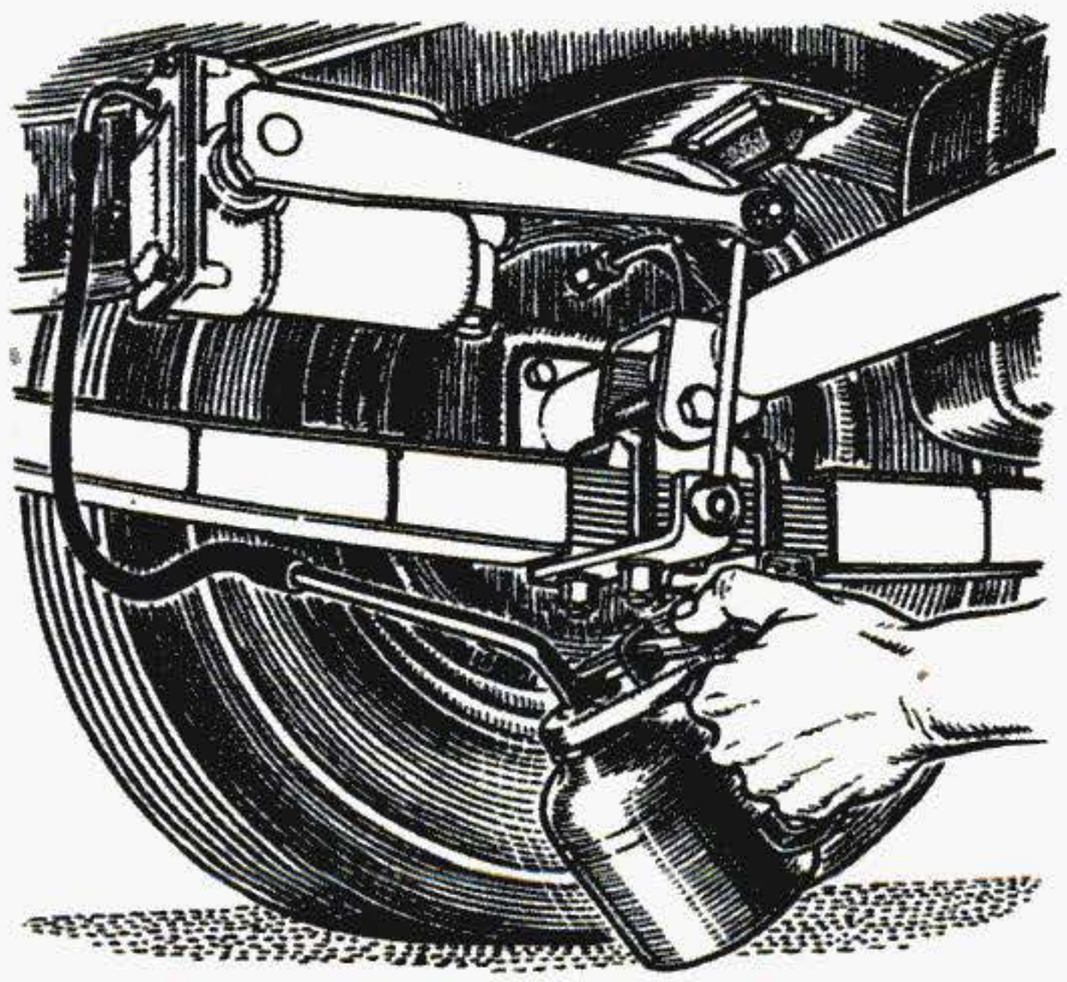
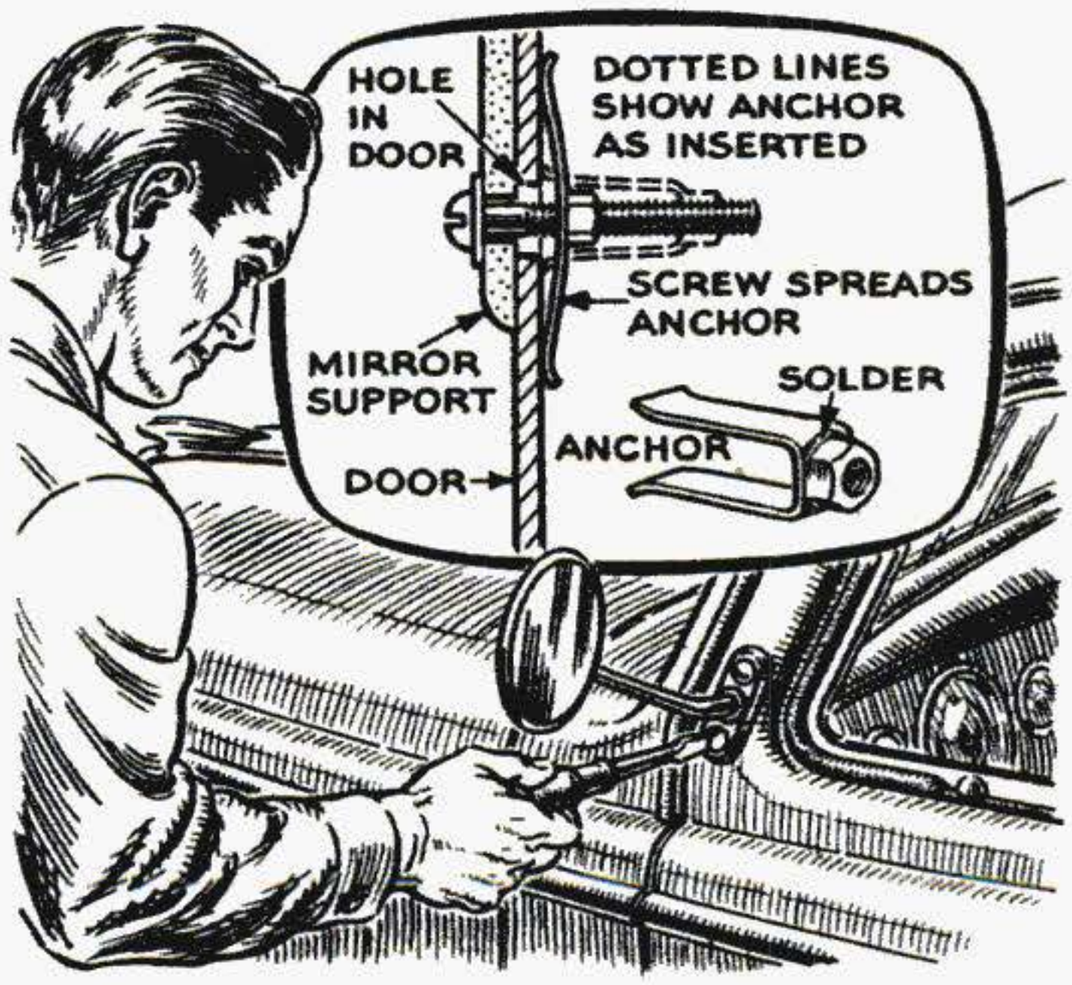


Jeep Engine Kept Dry. David Horvath, of Yonkers, N. Y., writes that he frequently had trouble starting his Jeep because water and snow collected around the spark plugs and on the battery and wiring. This sketch shows how he waterproofed the engine for less than 75 cents. The openings between the hood and mud guards were closed with ¾" by 1½" wood strips, fastened to the mud guards with wood screws. A length of weather strip diverts water flowing from the cowl. A blow-out boot protects the battery.

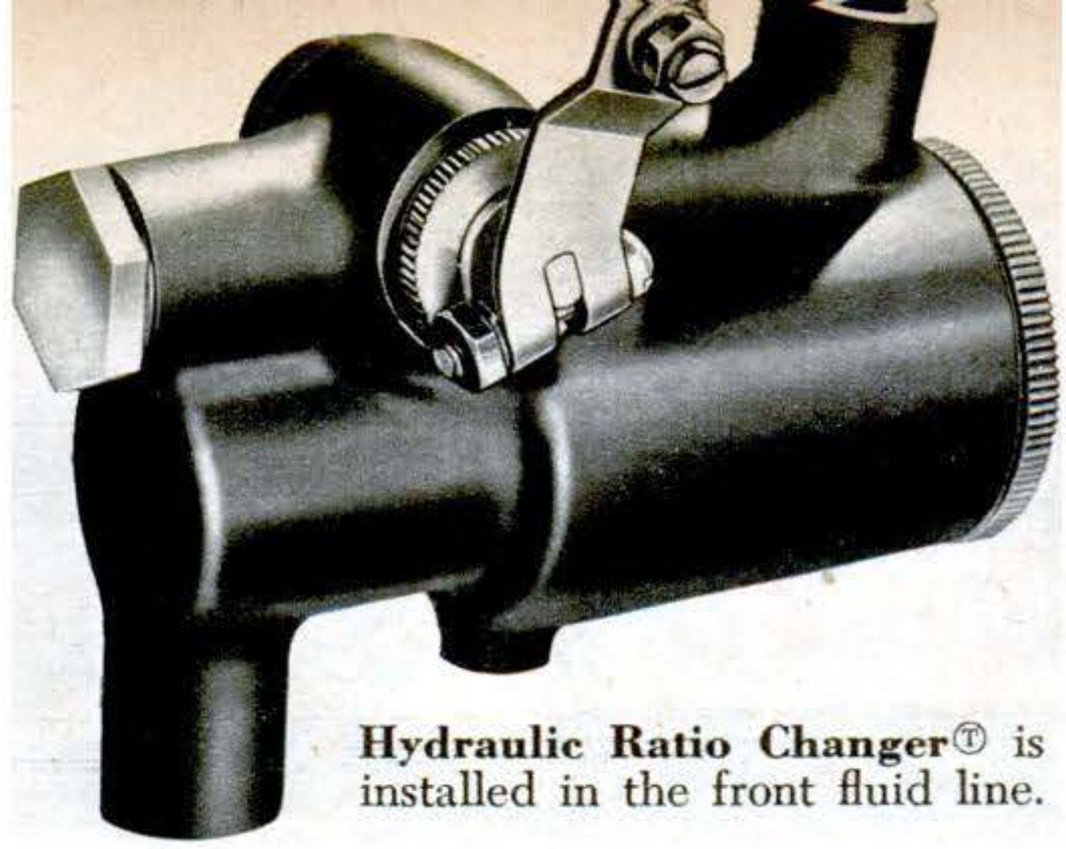


Shocks Filled with Oil Can. Here's a rig that will enable you to refill shock absorbers without difficulty when the filler plug is located in a hard-to-reach spot. Suggested by Marion L. Rhodes, of Knightstown, Ind., it consists of a pump-type oil can, a length of rubber tubing, and a small nozzle bent from copper tubing. With the nozzle inserted, a few strokes on the pump handle will quickly refill the shock.



Toggle Nut Holds Mirror. When the original self-threading metal screw tore loose, B. Leo DeMare, of Aberdeen, Md., devised the nut shown above to fasten a rear-view mirror to his car. A nut first was filed down slightly to clear a hole in the door frame. A strip of sheet brass was drilled, soldered to the nut and bent into a U. The nut and anchor were threaded on the bolt, inserted in the hole, and drawn up tight.

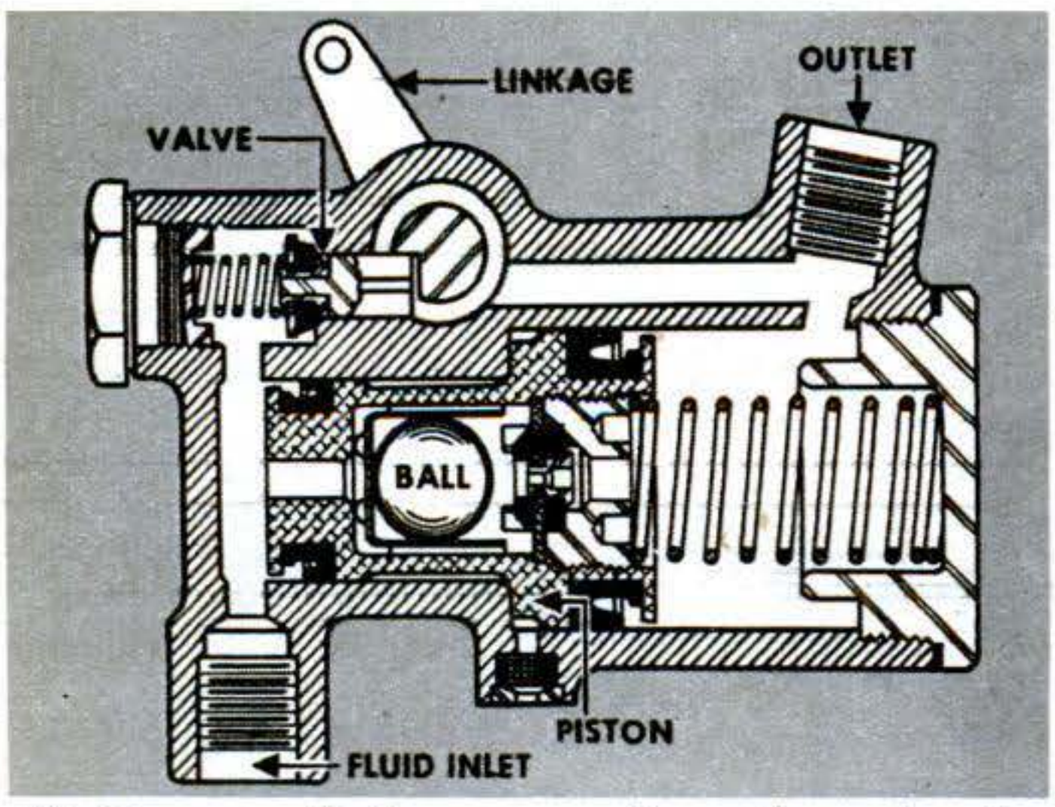
New Brake Control Reduces Skidding



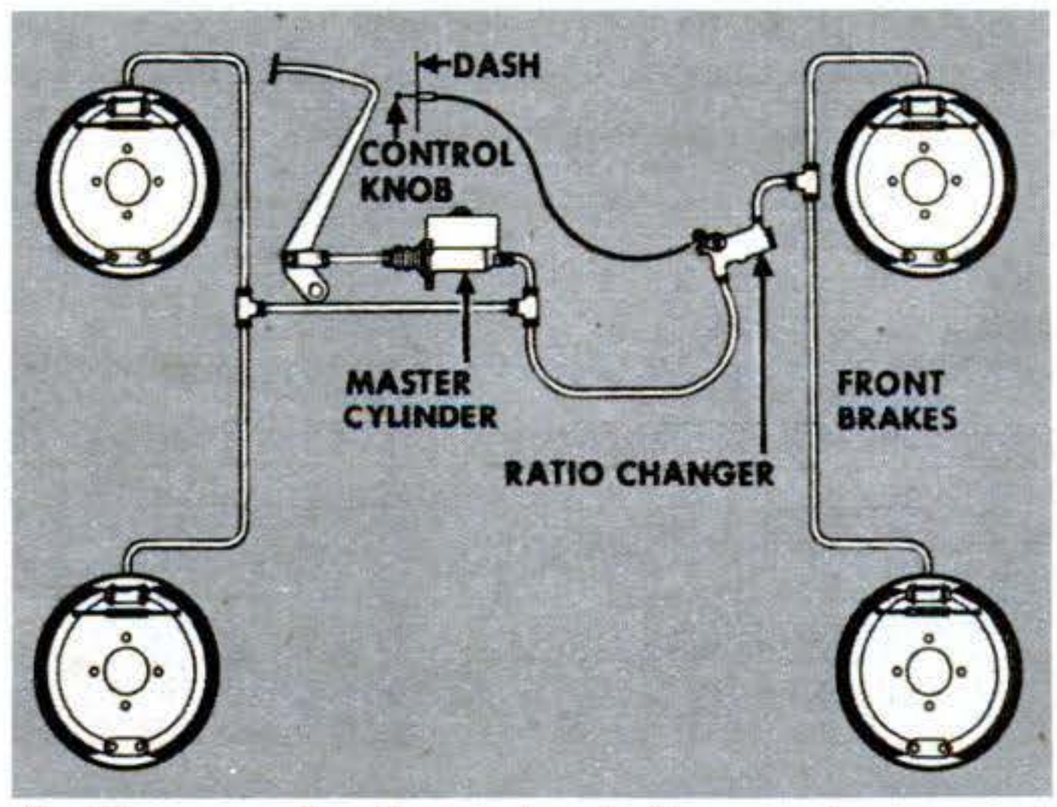
Hydraulic Ratio Changer® is installed in the front fluid line.

ON A slippery surface, it's bad medicine to hit the brakes hard. Not only are you asking for a skid, but if you lock the front wheels you may turn end for end.

A new safety device introduced by Wagner Electric Corp., of St. Louis, is designed to lessen the chance of skidding. For dry-road driving, you have full braking effort on all four wheels. For wet or icy conditions, pulling out a knob on the dash cuts braking pressure on the front wheels by exactly half. A step-diameter piston accomplishes this. Since the piston's output surface, facing the wheel cylinder, is double its input face, only half the pressure from the master cylinder is transmitted to the front brakes. This allows the front wheels to turn even if the rear are locked.

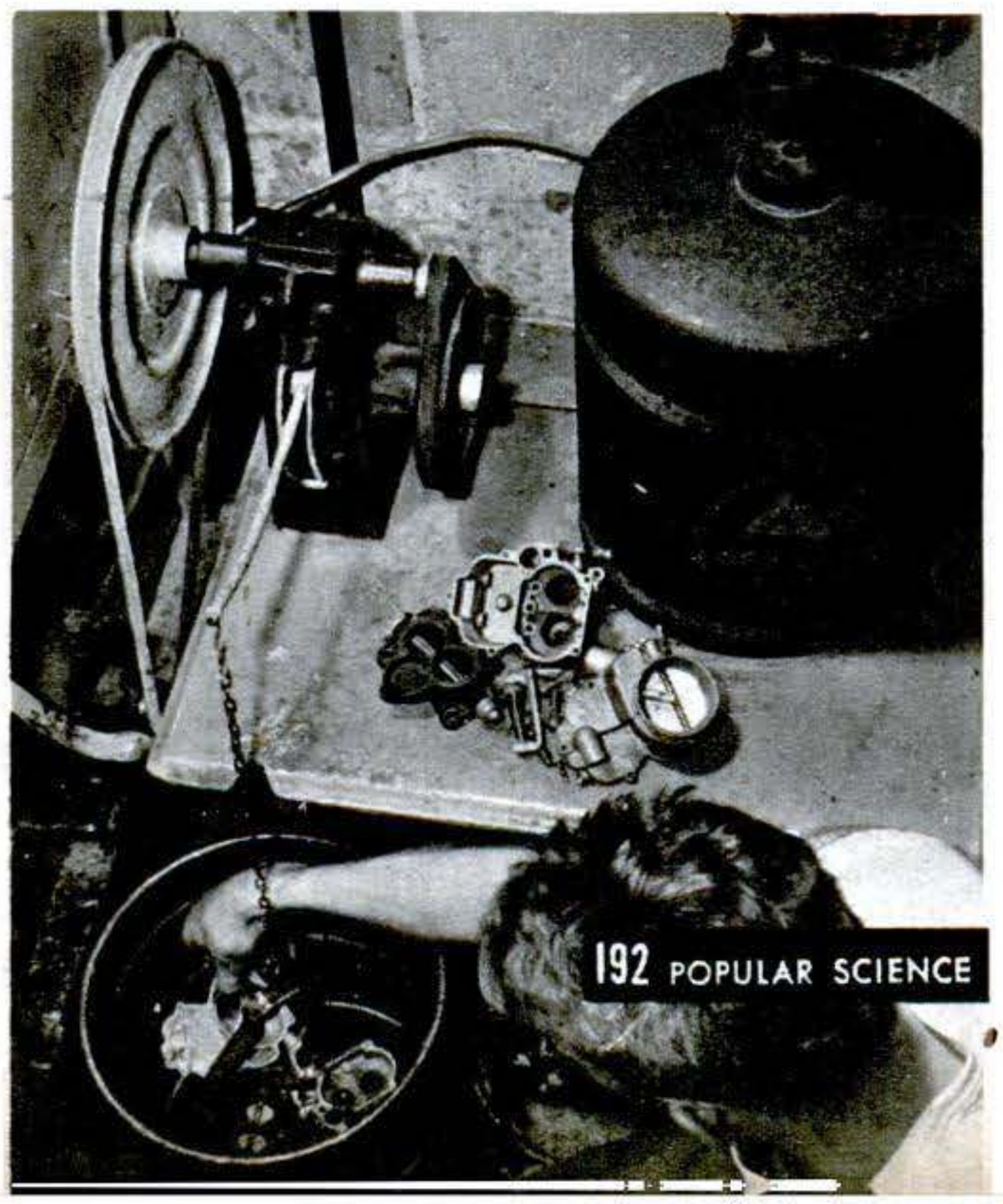


Fluid normally by-passes piston through valve at top for full braking effort on all the wheels.



Pulling out knob on the dash puts the control into operation. It acts on the front brakes only.

Carburetor Washer Uses Cream-Separator Parts



IN THE carburetor and ignition shop that Clyde Aikens runs in Lyons, Kansas, it's no longer necessary to spend time degreasing and cleaning dirty carburetors and other small parts by hand. The job is now done automatically in the homemade washer shown in this photograph.

Gears, housing, and other parts from an old cream separator were used to build it. An electric motor is belted to the large pulley at the left. This motion is transmitted through the small pulley at the other end of the shaft to an eccentric that lifts a projecting rod up and down. Held in a basket that's chained to the end of the rod, the dirty parts are automatically sloshed up and down in the solvent.

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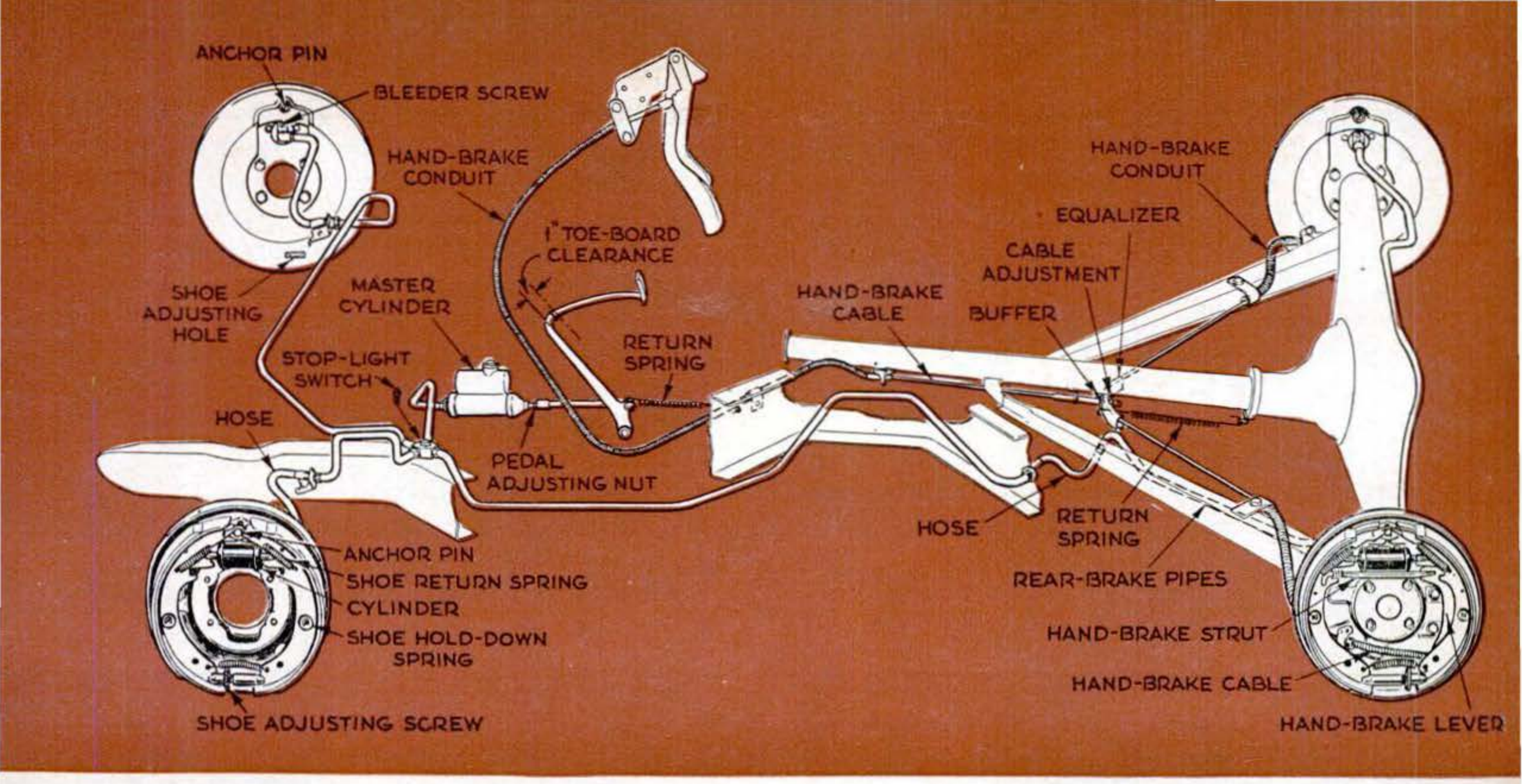


Above is a typical hydraulic braking system on a late-model car fitted with Bendix brakes.

How an Expert Repairs Brakes

By R. P. Stevenson
PS photos by W. W. Morris

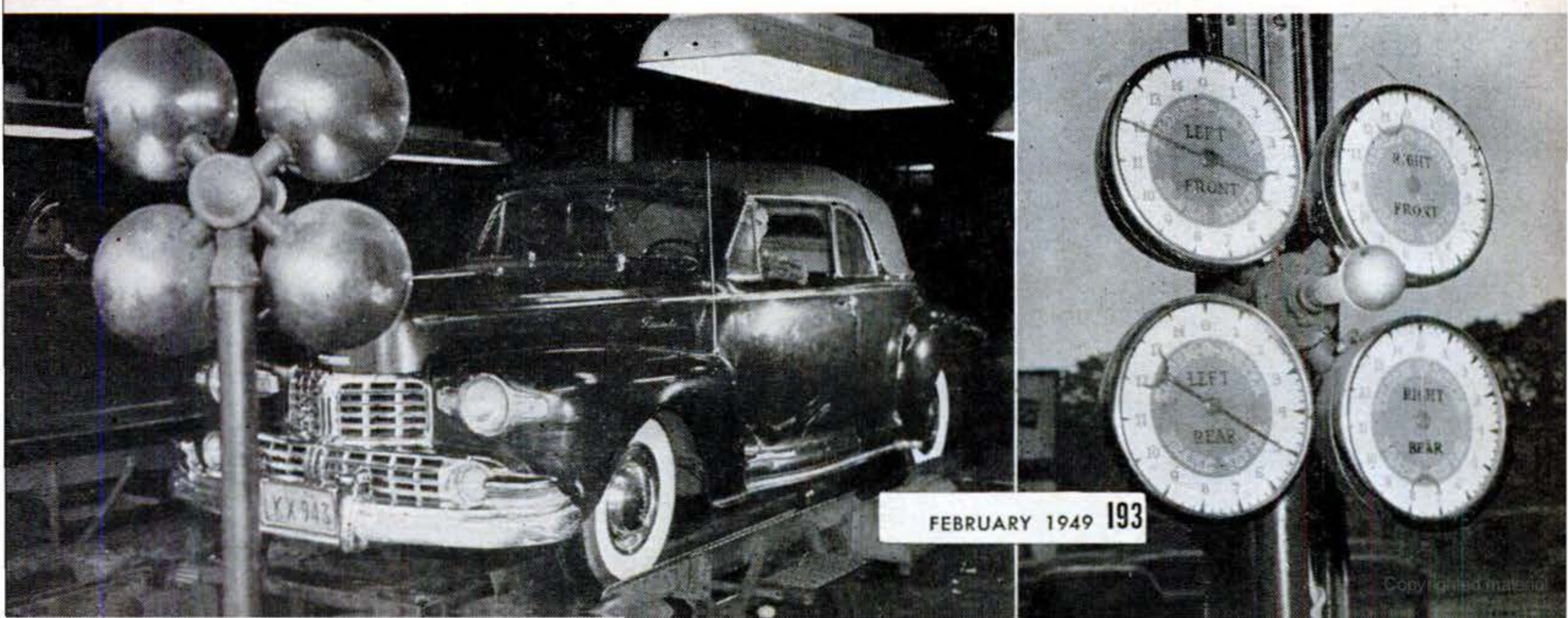
EVERY business has its experts. In any big brake shop, you may find several—mechanics with long experience who are locally known as the "best in the business."

Talk to them, and you'll learn that their abilities go well beyond the instruction-book techniques. They have their own pet shortcuts. They're capable of invention. In the accompanying photos, you'll notice several variations from traditional brake-repair procedure that sprang from this bent.

The photos were taken in one of the ten brake shops run by S. G. Tilden, Inc., in New York, New Jersey, and Connecticut. This company developed the Permafuse

1. Quick check-up. If you should take your car to one of the Tilden shops, it would first go on tester like this. Four dials (in foreground facing mechanic) register the braking power.

2. What's wrong here? When the Lincoln at the left was tested, here's what showed up on the dials. The right rear brake failed to register at all, and the others indicated unbalance.



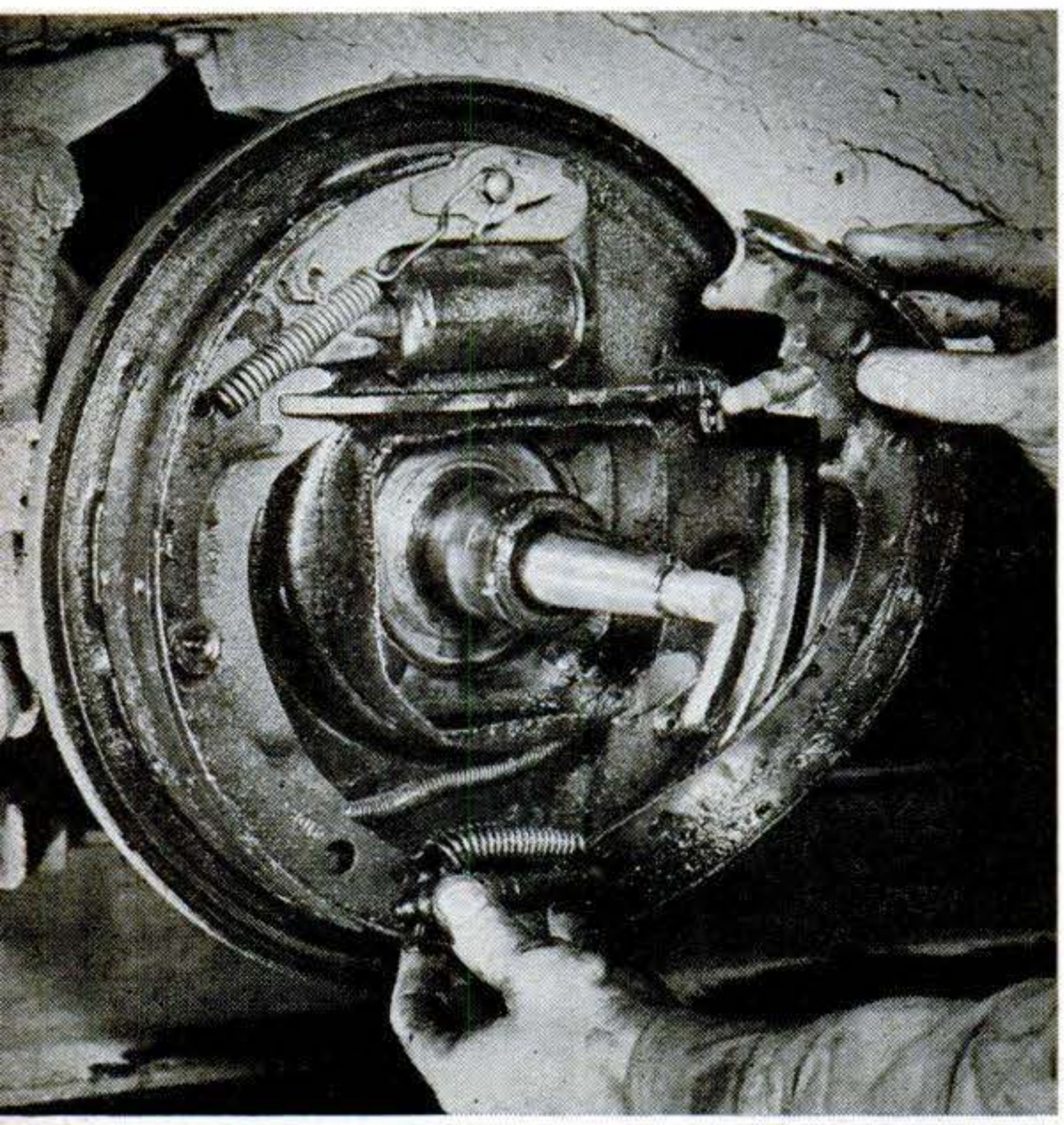
method of bonding brake linings to the shoes (PS, Nov. '47, p. 156). It now has abandoned riveting entirely.

That's why you'll find no riveting operation in this sequence of photos. Even in a shop where riveted linings are the rule, a riveter might not have been in use. Many shops now install shoes already reconditioned and lined by factory or supplier.

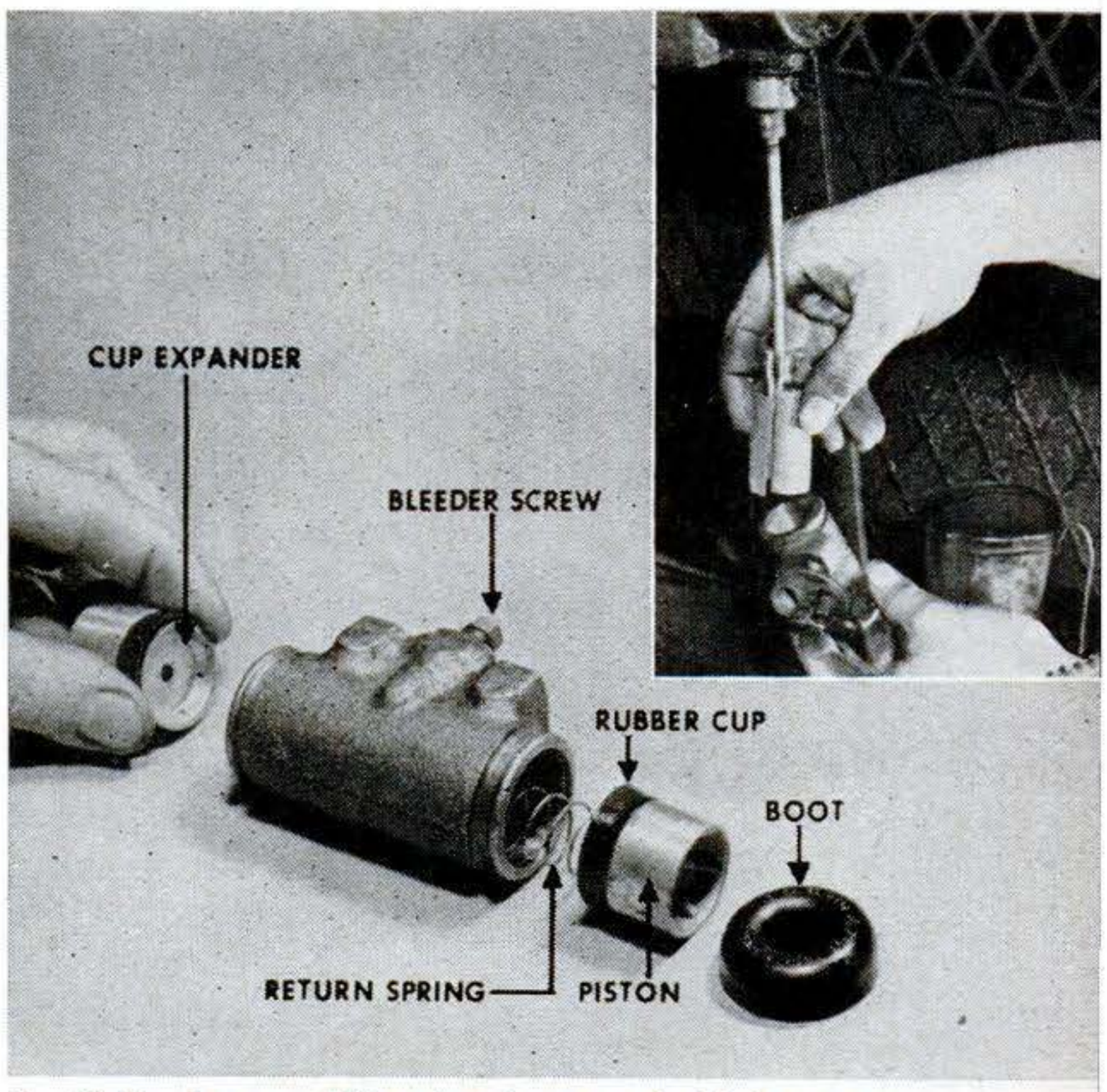
Shown in the photos are typical repair operations that might be performed by any first-class mechanic when your brakes begin to chatter, grab, drag, or otherwise demand attention.

The brakes illustrated are a Bendix product. Brakes of this make are found on the Hudson, Lincoln, Nash, Packard, 1949 Ford and Mercury, and all General Motors cars except Chevrolet, which uses a Huck brake. Studebakers, Jeeps, all Chrysler Corporation cars, and Fords and Mercurys previous to 1949 are equipped with the Lockheed type, but repair operations are generally the same as pictured here.

In a Tilden shop, a complete overhaul of your brake system takes just about two hours. The car goes first to a testing rack for a quick diagnosis of braking efficiency. This tester includes a refinement developed by the Tilden company itself. Torque read-



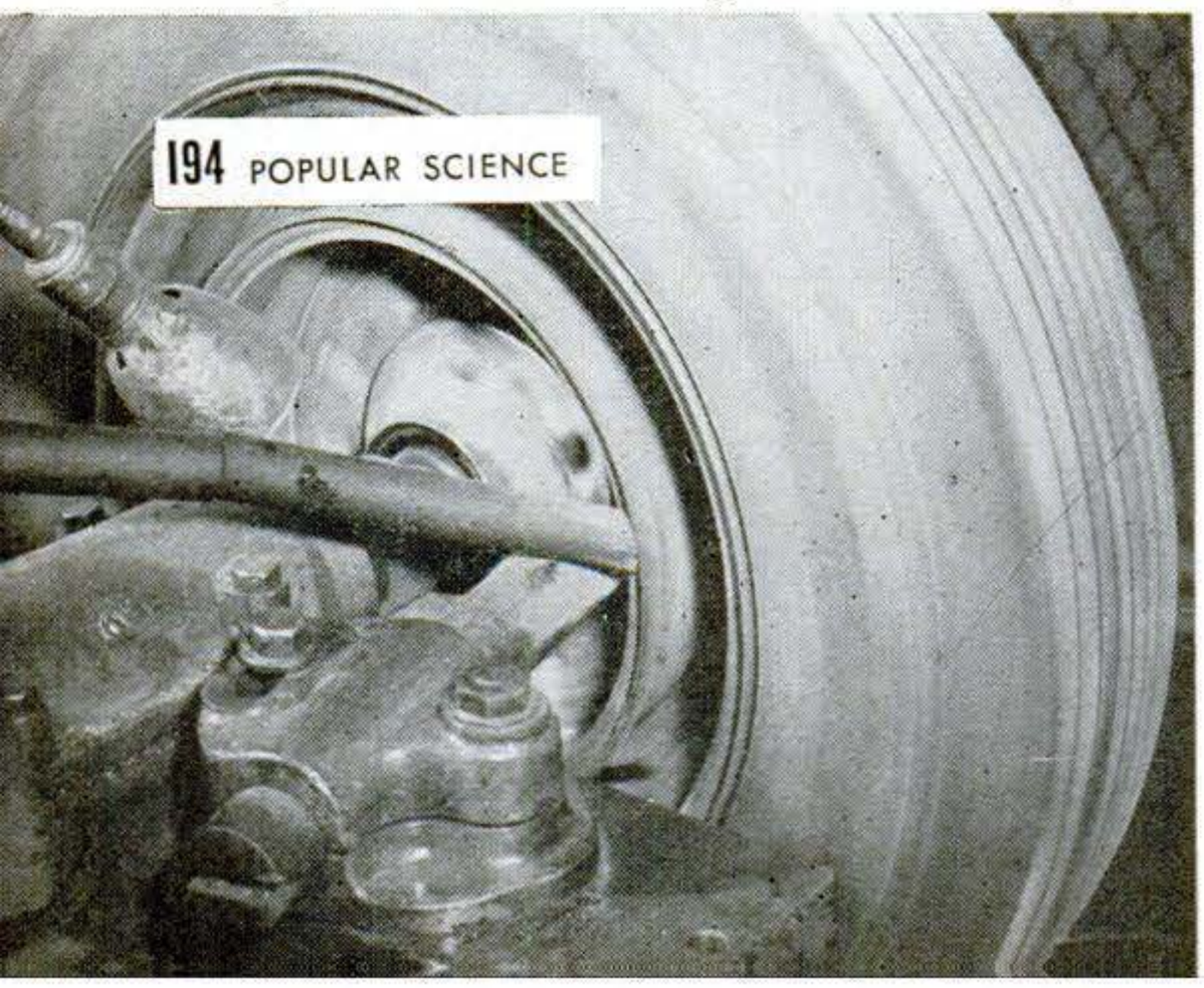
3. Right rear brake had been knocked out by rear-end grease leaking through the retainer. New linings were in order and springs were replaced because heat had removed the temper.

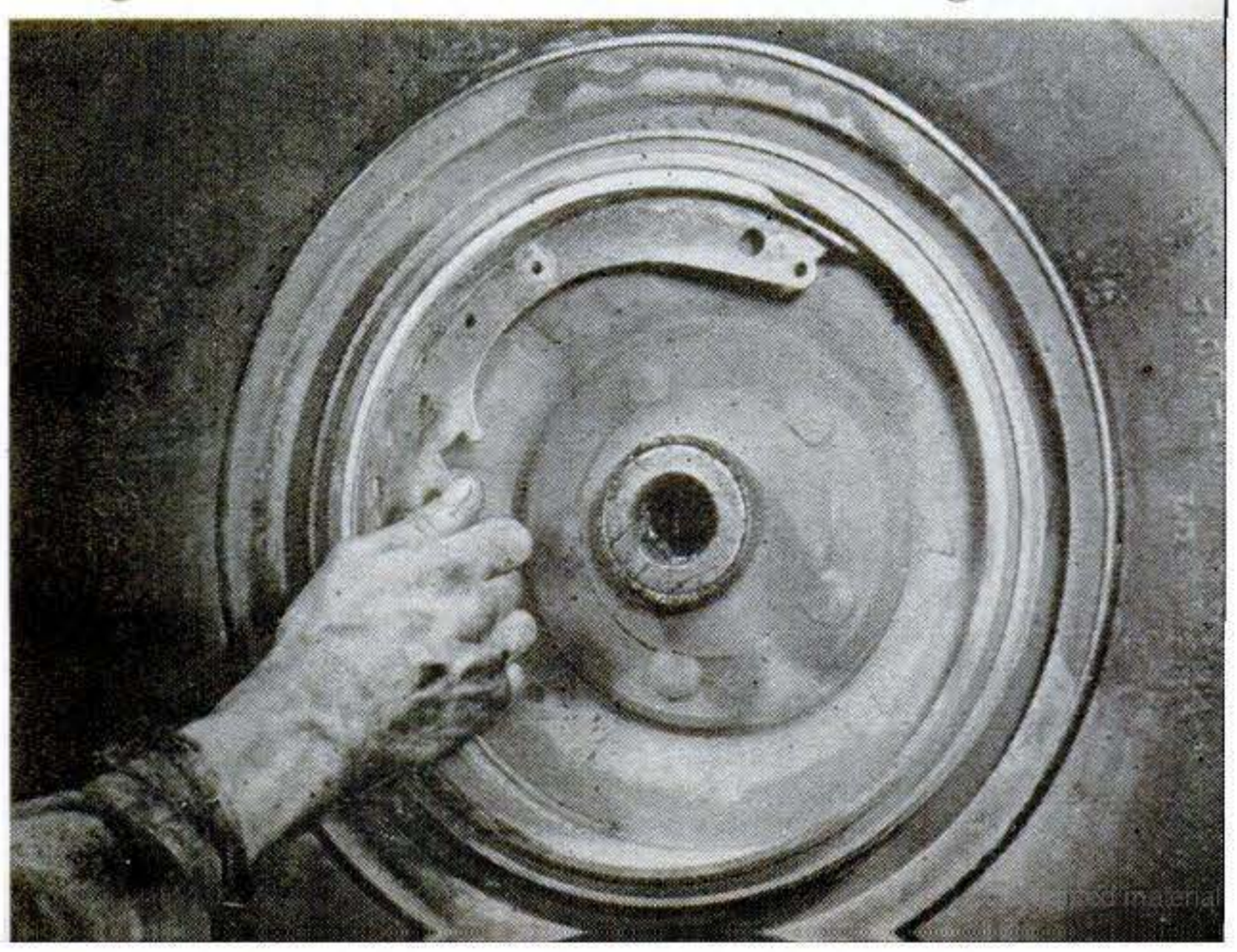


4. Cylinder on this wheel was rebuilt because fluid was leaking. In such cases, the casing is usually honed (inset) to smooth down any irregularities. Parts go together as shown.

7. Drum is refaced on special lathe if scored or out of round. The normal cut varies from .006" to .008". Cuts up to .020" are sometimes made, but oversize linings are then required.

8. Shoe and lining should conform to the drum arc before installation. A quick check is made in this manner. During use, shoes may deform enough to cause uneven wear on the linings.





ings from each wheel are relayed simultaneously to a panel of four dials. This makes it unnecesary to test each wheel individually.

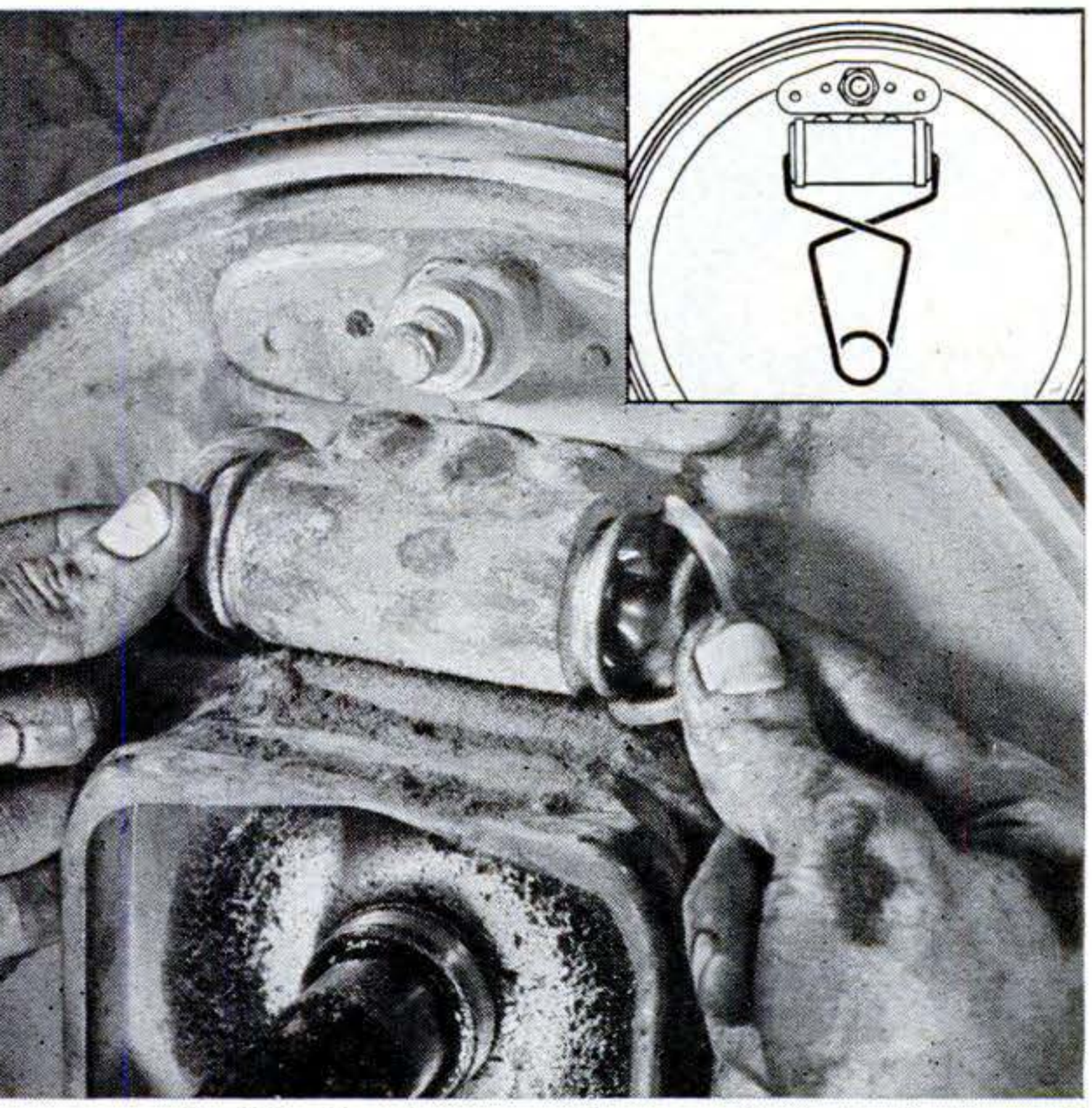
With brake performance measured, the car is moved to a lift and raised high enough for the mechanic to work in comfort.

In Fig. 3, you'll note that every part of this brake had a coating of grease. The linings were impregnated with it.

This trouble occurs more often than you may think. As likely as not, it results from the desire of some untrained grease monkey to give you your full money's worth when he fills the differential housing. A good rule to follow is to keep the grease level just a little below the filler opening. Excessive grease in the rear end tends to break through the seals.

This lubricant level is one thing a good brake mechanic will check before releasing the car to you. He'll also take up end play in the rear axle, pack wheel bearings with the proper lubricant, and inspect and tighten the bolts that hold the backing plates to the steering knuckles and rear axle housing.

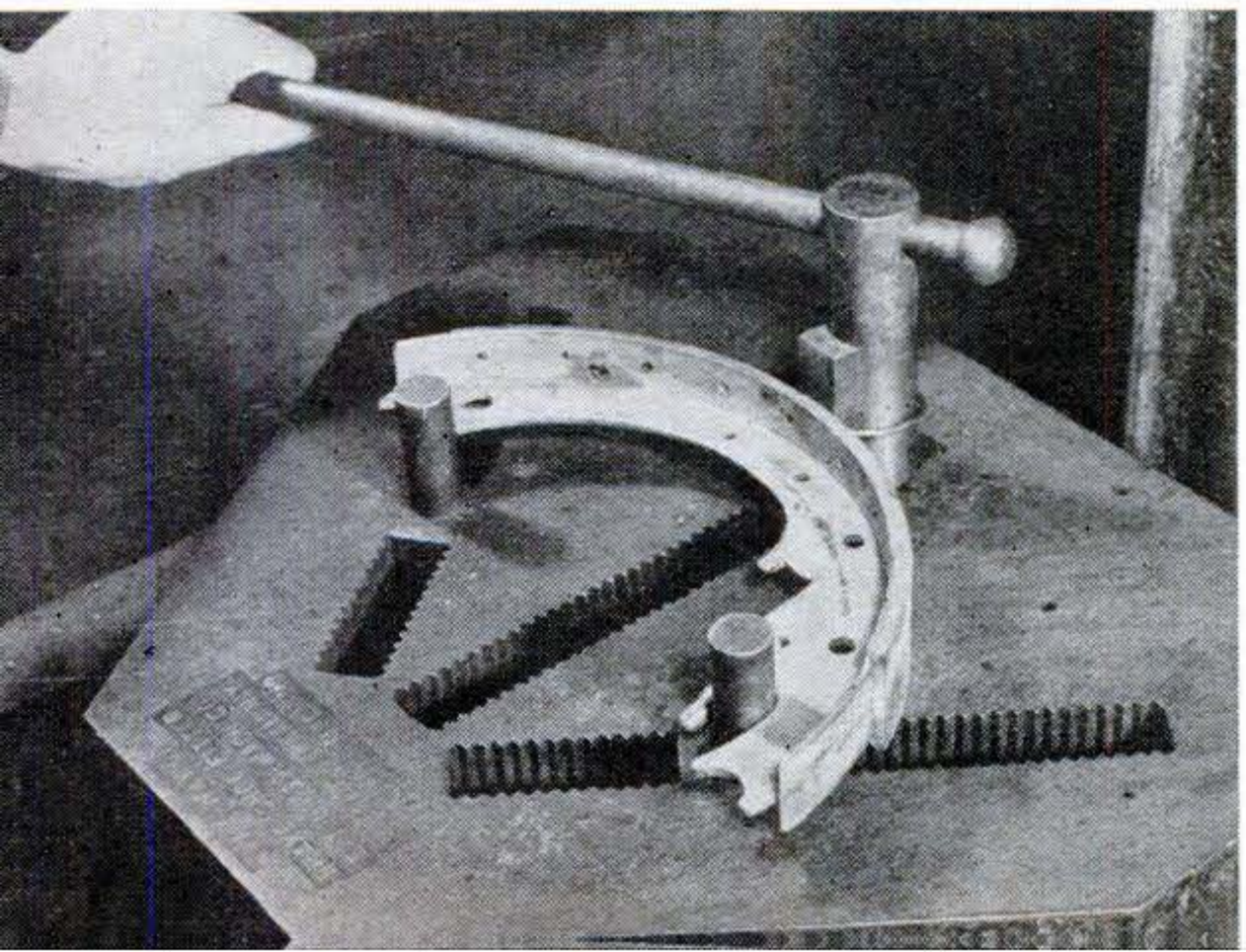
At Tilden's, the final step is another trip to the testing rack. When braking power satisfies the calculations of the tester, the car is considered ready for you.



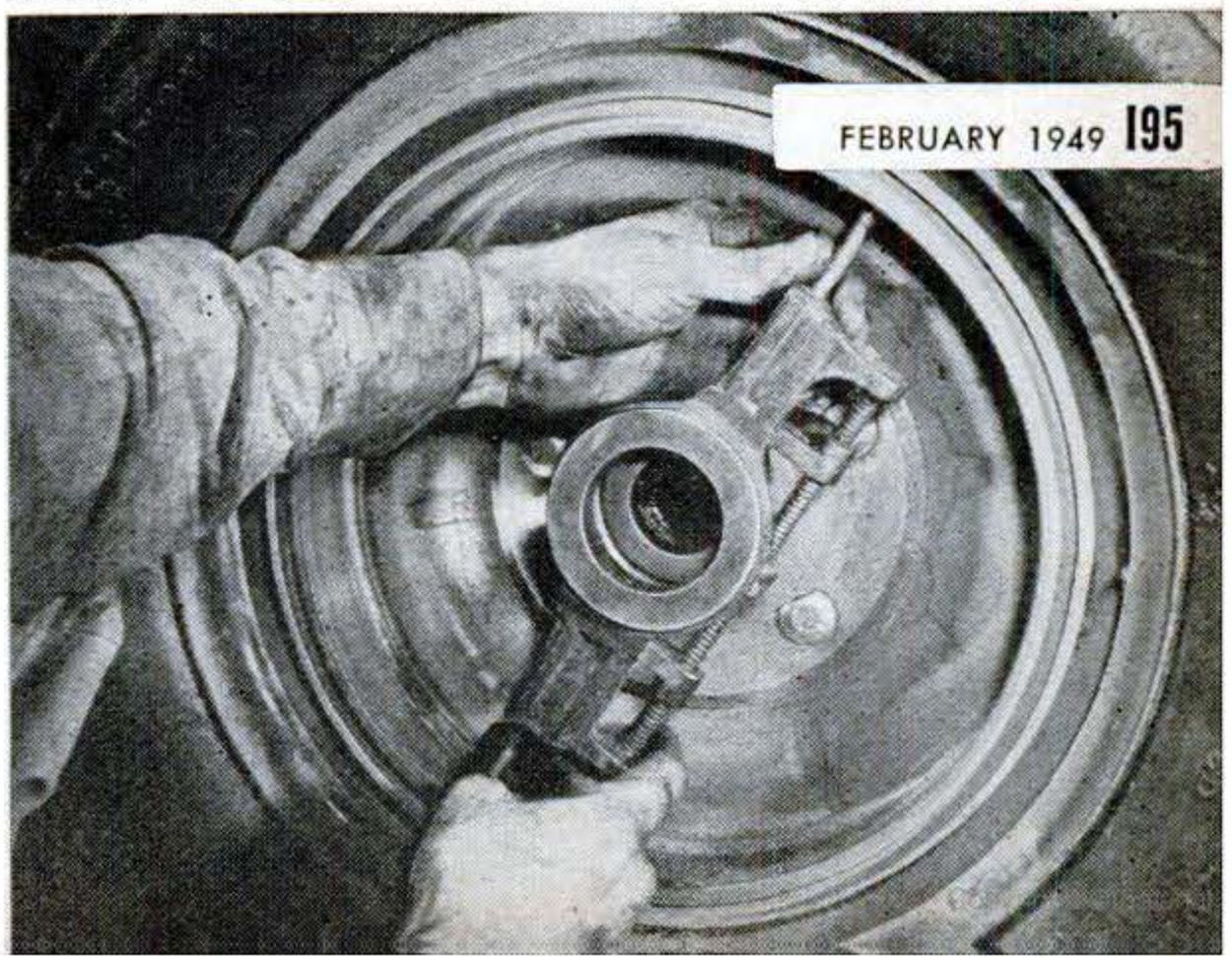
5. Mechanic opens boots to look for leaks, and checks piston action with fingers. Clamp normally used to hold piston against fluid pressure wasn't needed here; lines had drained.

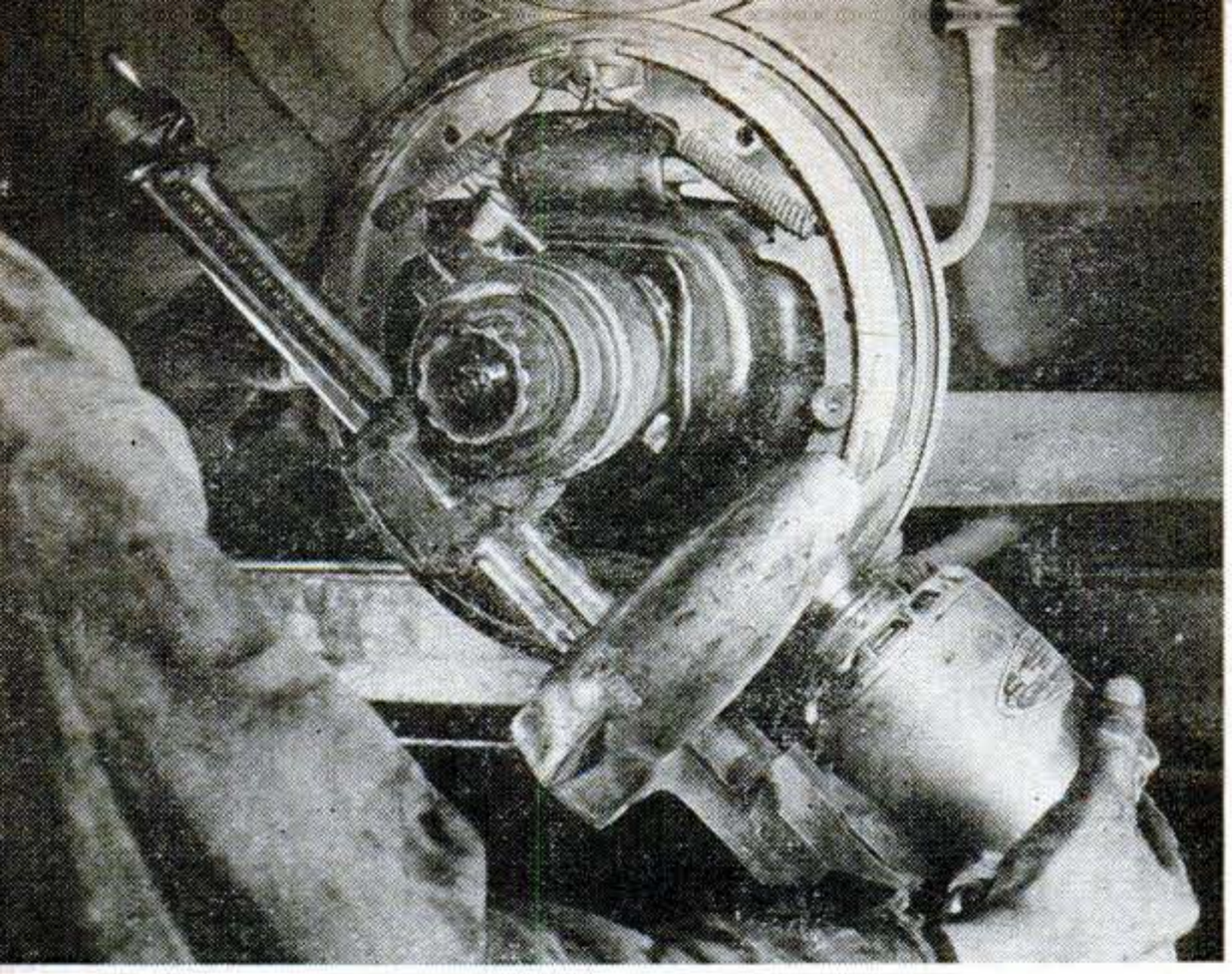
6. Special lubricant is applied to the backing plate at points where shoes will bear against it. Any grease, rust, or dirt is first cleaned from the plate with a wire brush.

9. If shoe doesn't fit, it's taken to a fixture and sprung so it does. Here fixture is set to remove belly from shoe. When ends touch and middle doesn't, the shoe is sprung other way.

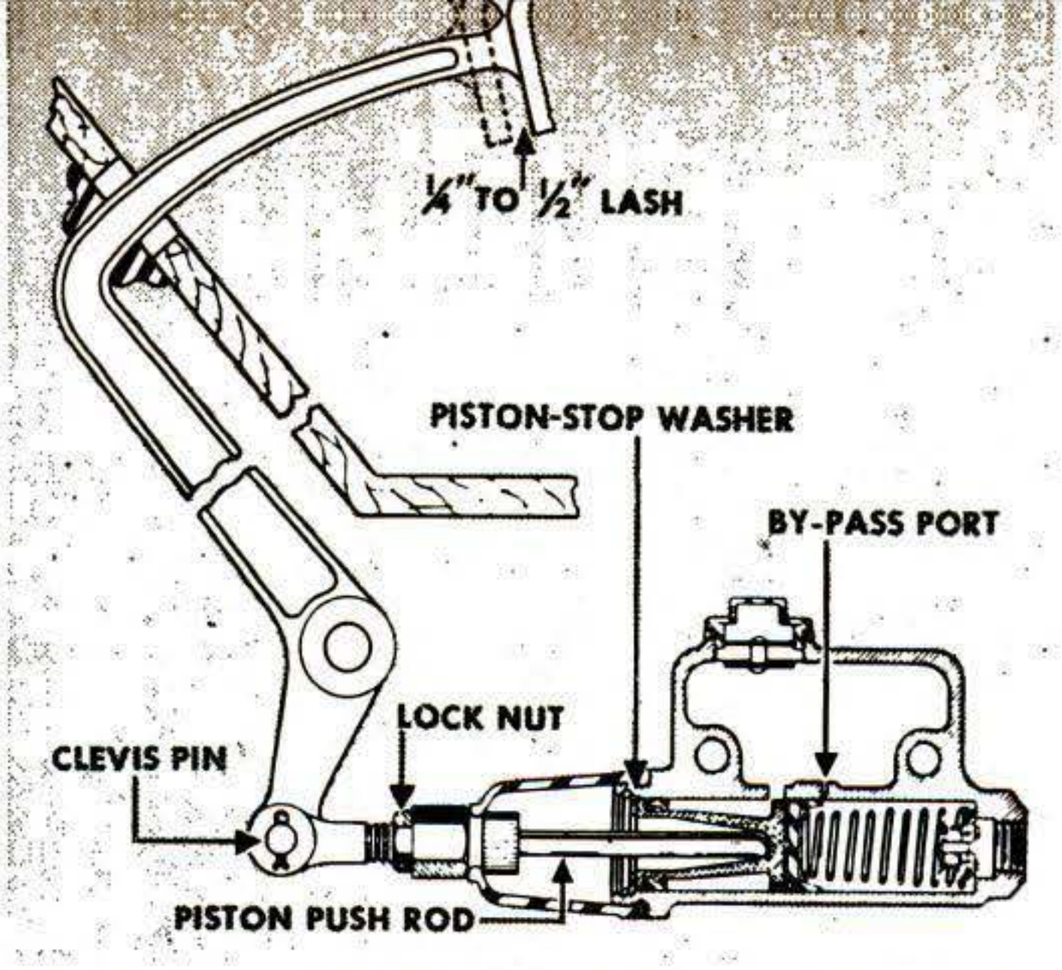


10. Drum is "miked" as first step in grinding new linings. Radius grinder is set about .008" less than this measurement. Slightly oversize linings are used when they're to be ground.

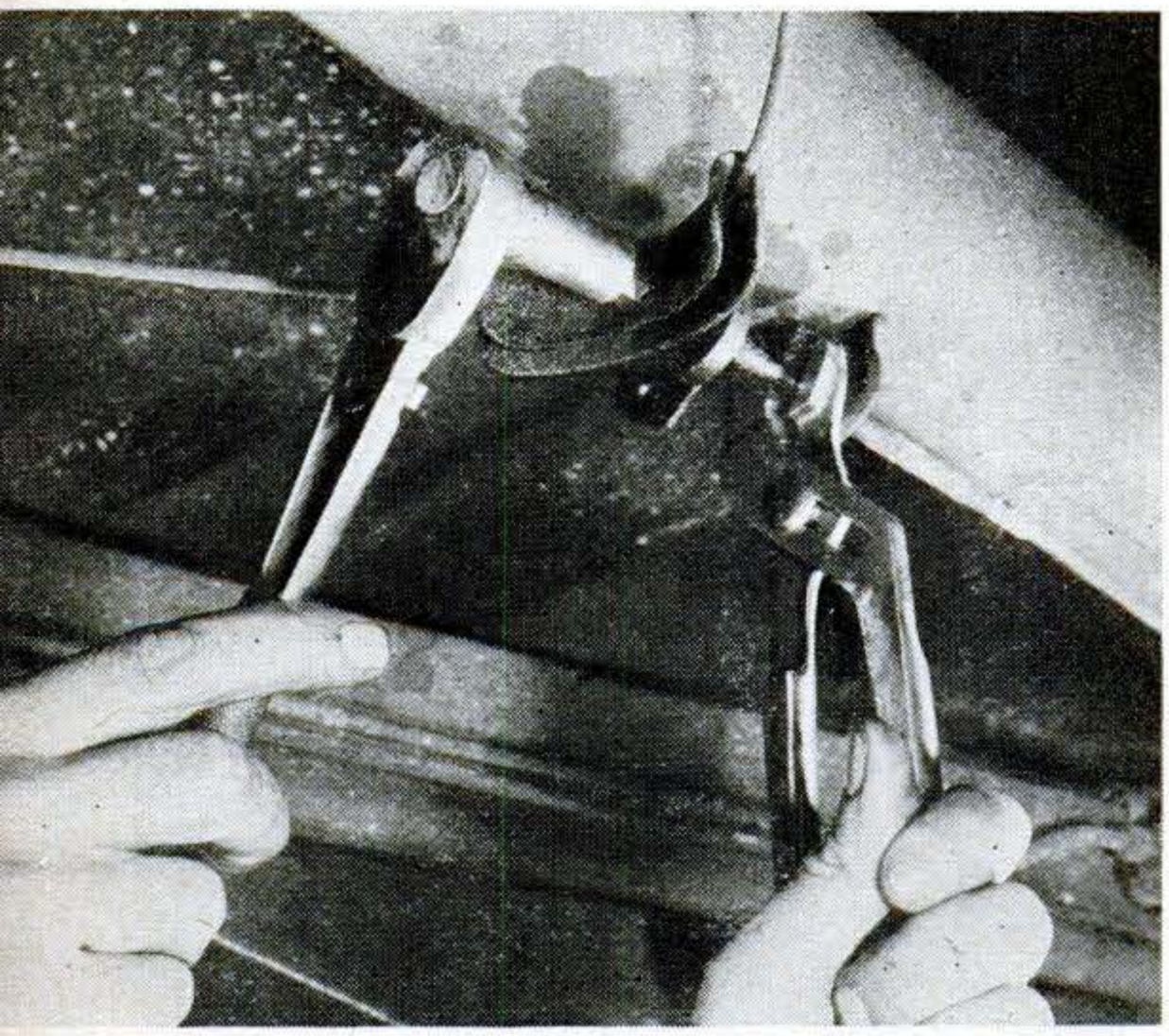




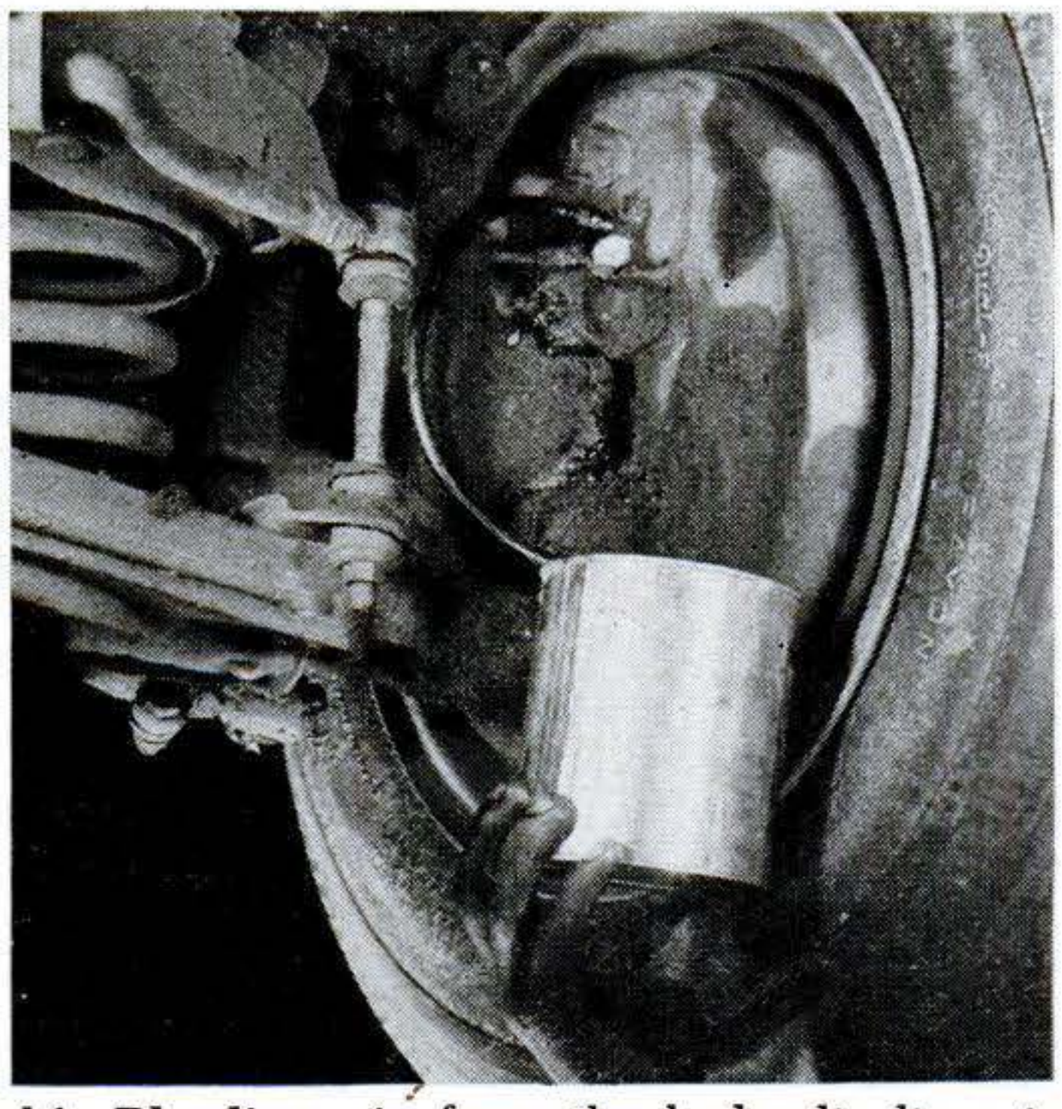
11. Radius grinder pivots on axle. After using it as a guide to set anchor, mechanic grinds .008" from heel and toe and smooths center of lining. This eliminates need for break-in.



12. Master cylinder and brake pedal are also given the once-over. Pedal should have ¼" to ½" play and be set so push rod allows piston to clear by-pass port when brakes are off.



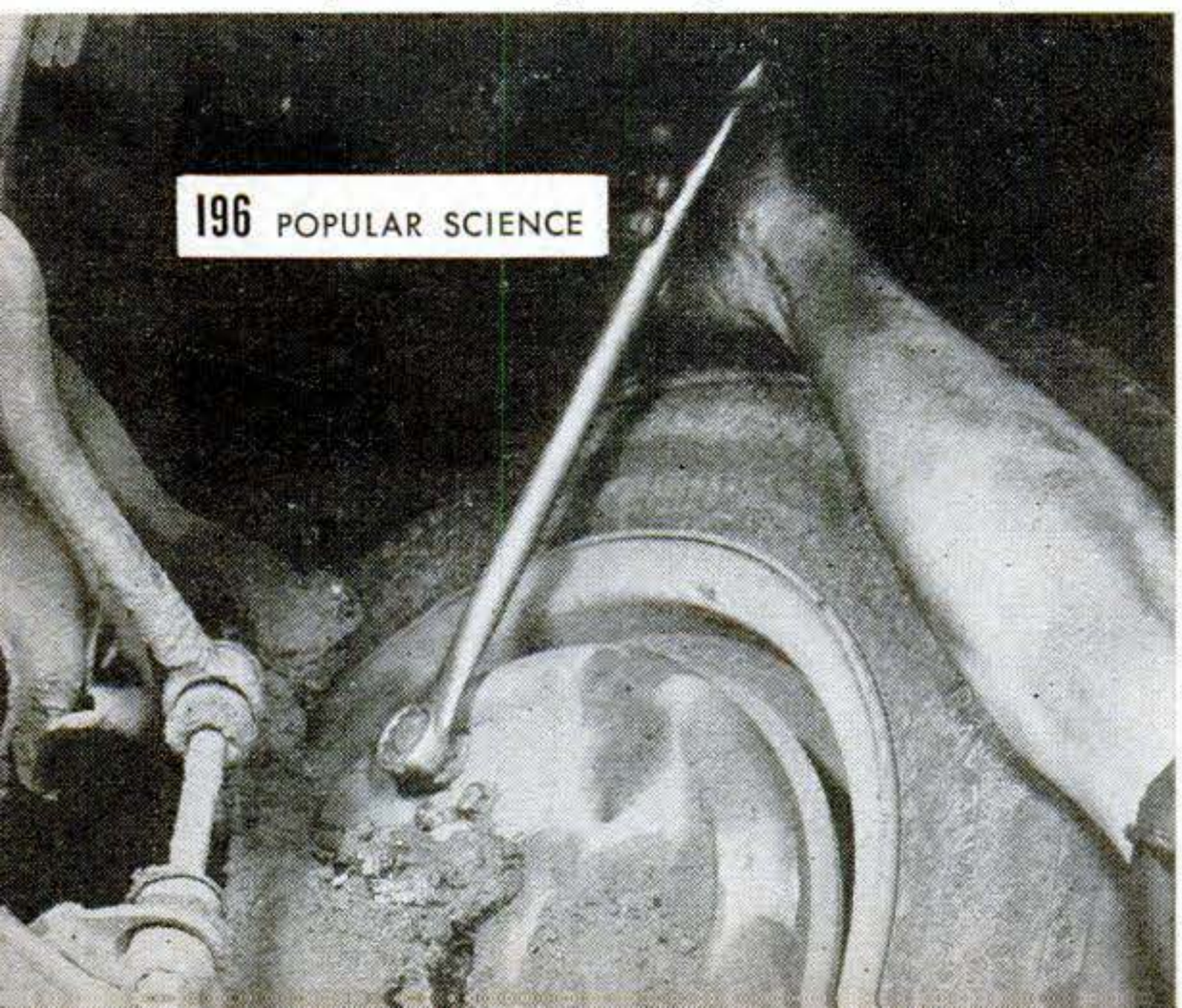
13. Parking-brake system likewise is checked through. When cable requires adjustment, it's done as above. Return spring has been removed here. Equalizer is seen between the wrenches.

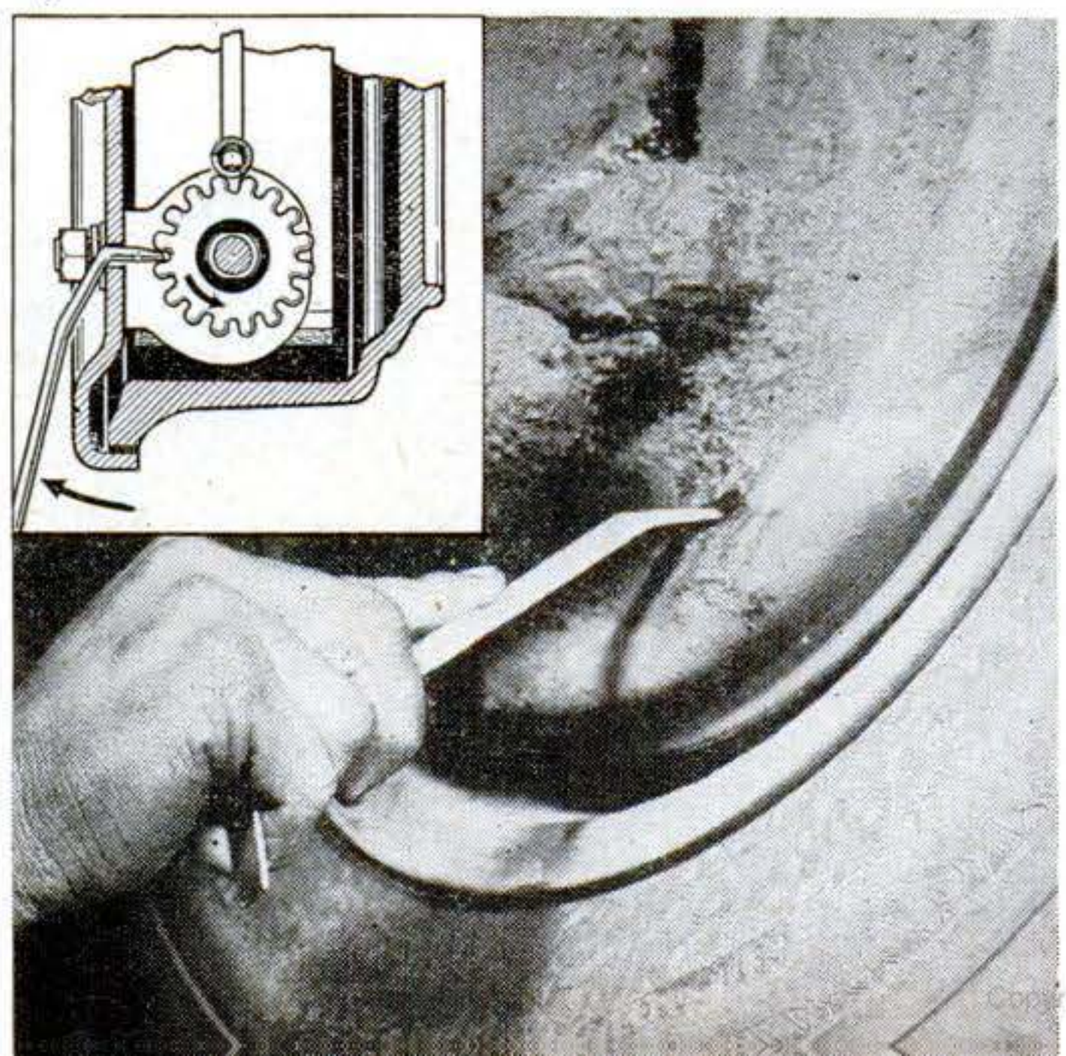


14. Bleeding air from the hydraulic lines is final step. A small hose is threaded into the bleeder hole and its end placed in container while fluid is fed into the master cylinder.

15. Anchors are set after the drum's in place if a shop doesn't grind the linings as seen in Fig. 11. In any case, the mechanic uses a 16" wrench, as above, to tighten anchor-pin nut.

16. Adjusting shoes like this is often the only attention brakes need. It compensates for worn linings. Expand shoes until drum just turns by hand. Then back off about 14 notches. END





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Mechanics and Handicraft

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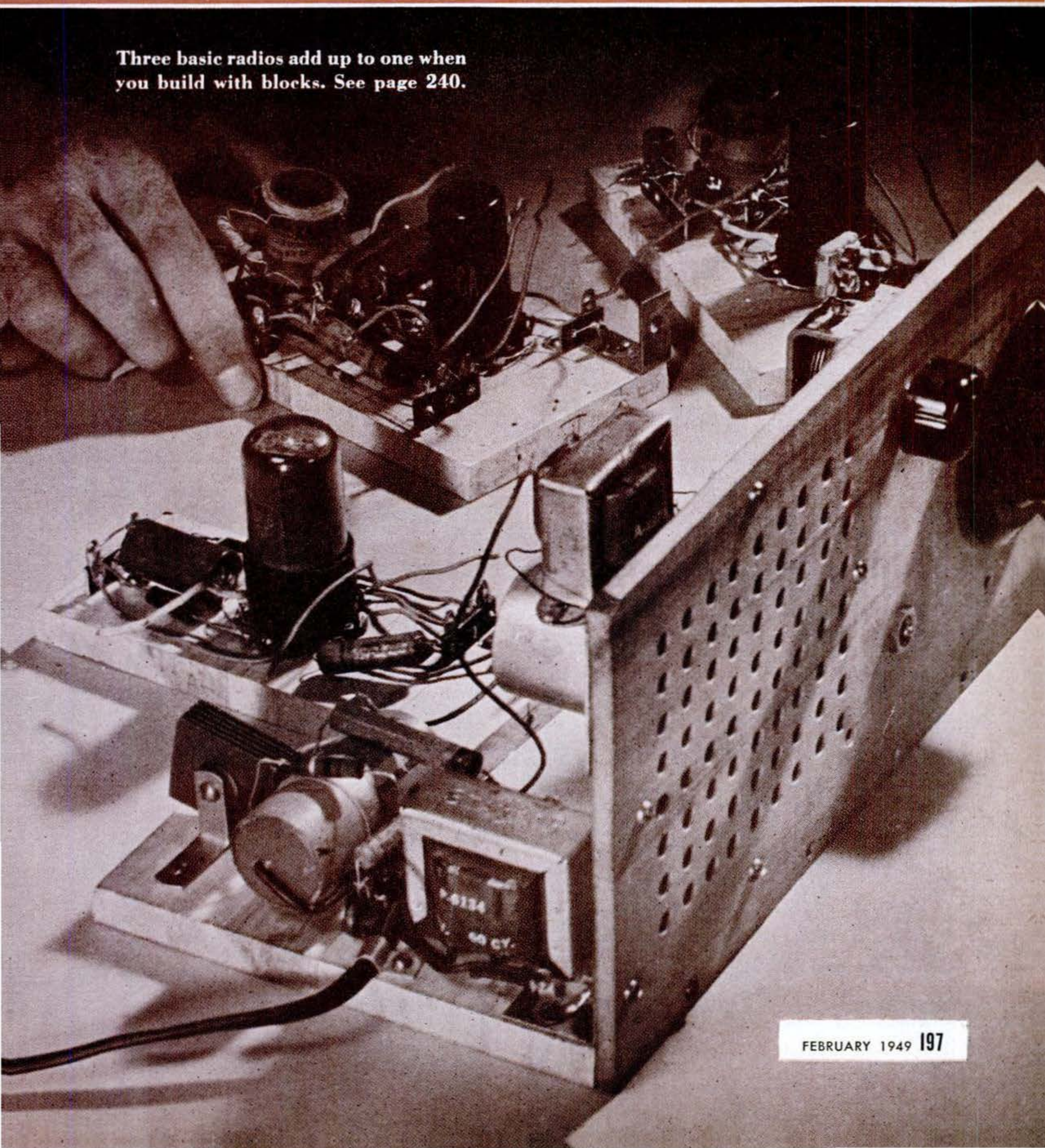
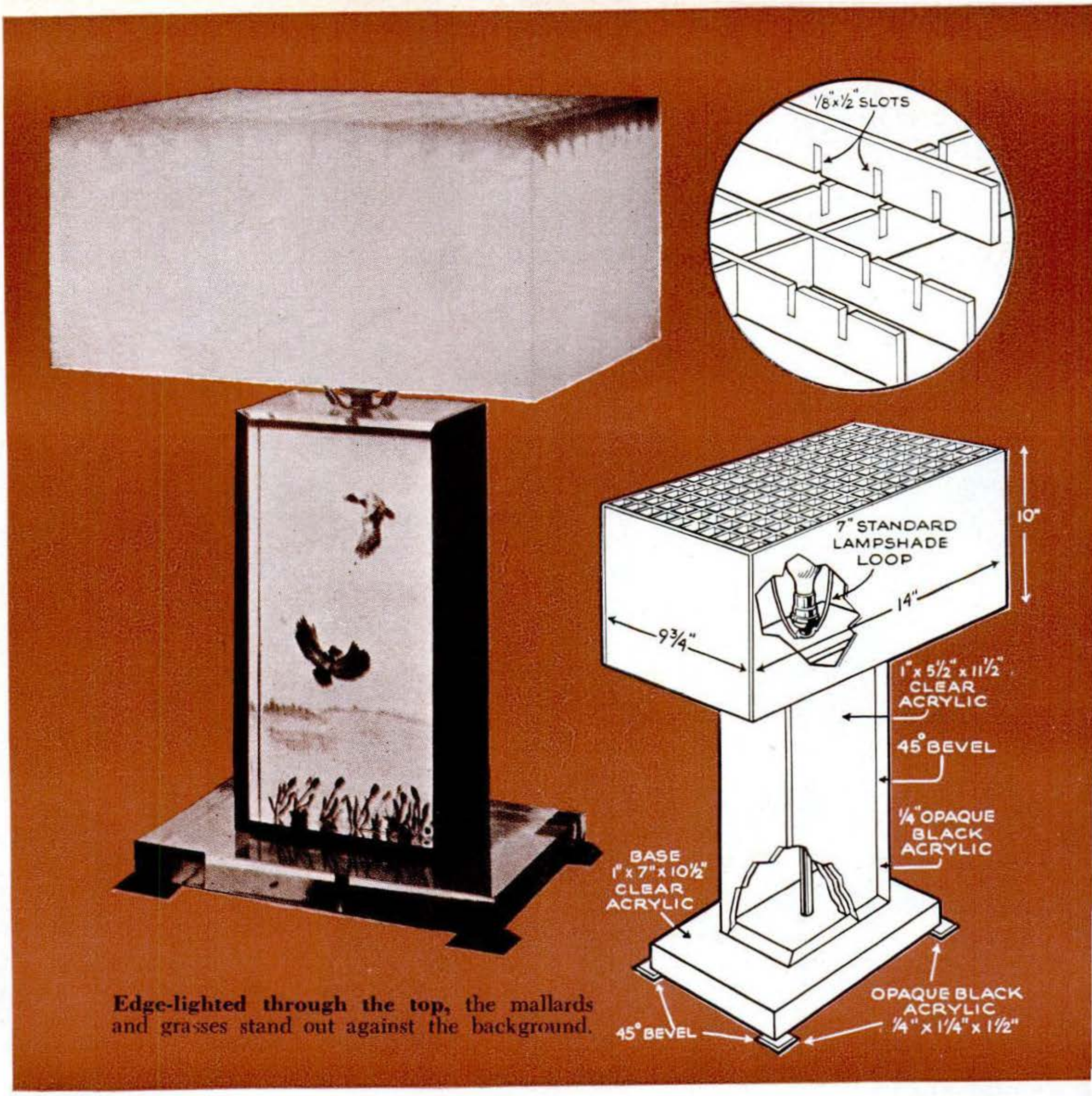


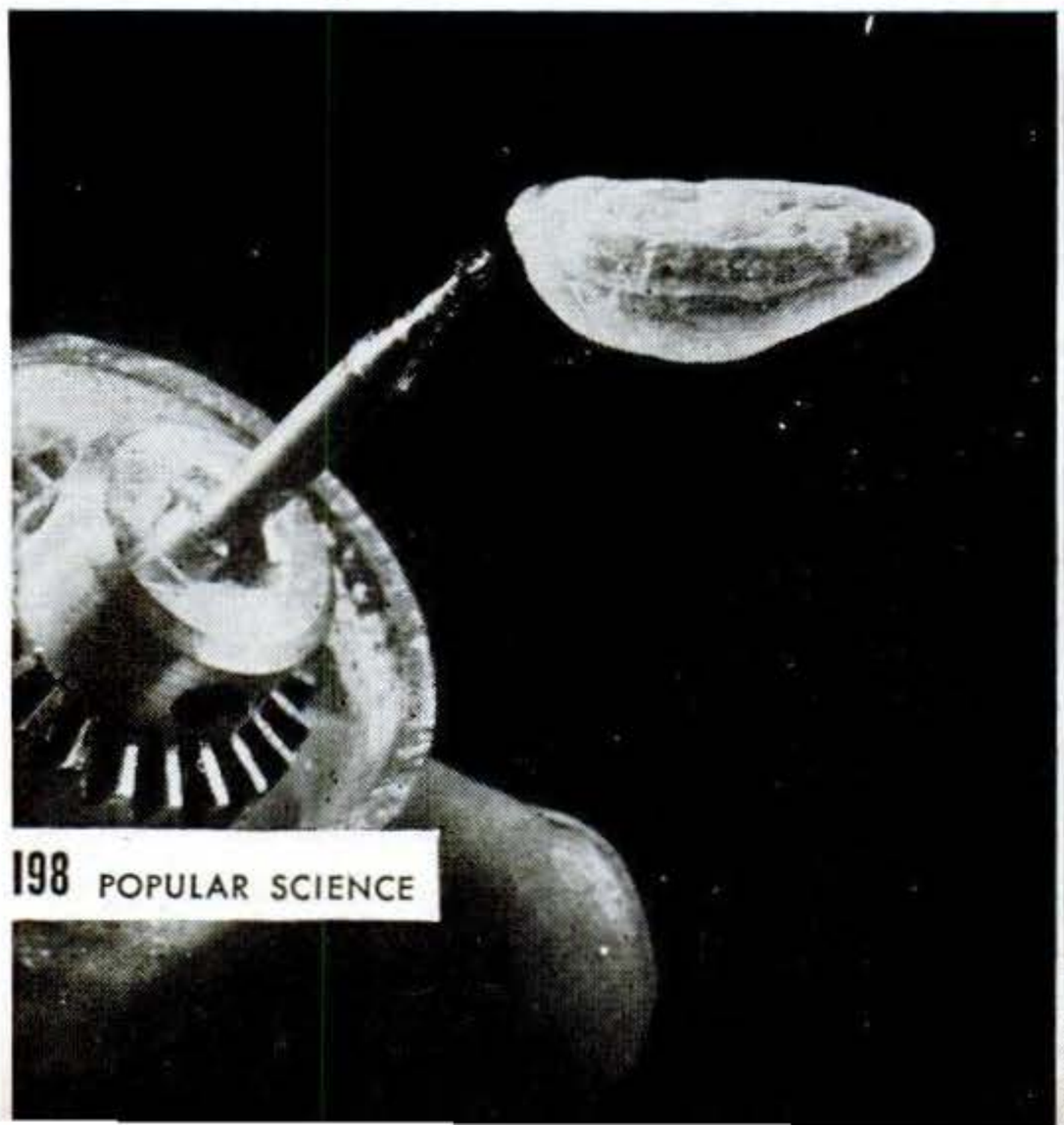
Three basic radios add up to one when you build with blocks. See page 240.



Edge-lighted through the top, the mallards and grasses stand out against the background.

Carve the bodies with a ball cutter or a pear-shaped burr. Work from the back and watch the drill through the front face of the plastic.

Cut out the feet with a small ball cutter. Position the head and neck so you'll be able to go in with the spiral drill to carve the beak.



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Internal Carving Decorates Plastic Lamp

By Harry A. Zoback

THE flashing color and action of mallards swooping low over a stretch of marsh are captured in plastic for this table lamp. Although the birds and swamp grasses appear to be three-dimensional objects embedded in clear plastic, actually they are carved out of it.

To make this internal carving, you'll need a high-speed hand grinder or a flexible-shaft tool and at least three bits: a pear-shaped burr or a large ball cutter, a small ball cutter, and a spiral drill (PS, Aug. '47, p. 160). If you aren't experienced at this form of carving, practice on scraps before cutting into the main panels.

Start by sanding and polishing the edges of the 1″ by 5½″ by 11½″ stock. Then you'll be able to watch the depths of the cuts. First carve the bodies with the pear-shaped burr or large ball cutter. Arrange the position of the heads so you can carve the beaks without disturbing the body carving. Use the spiral for the bills and the small ball cutters for the feet.

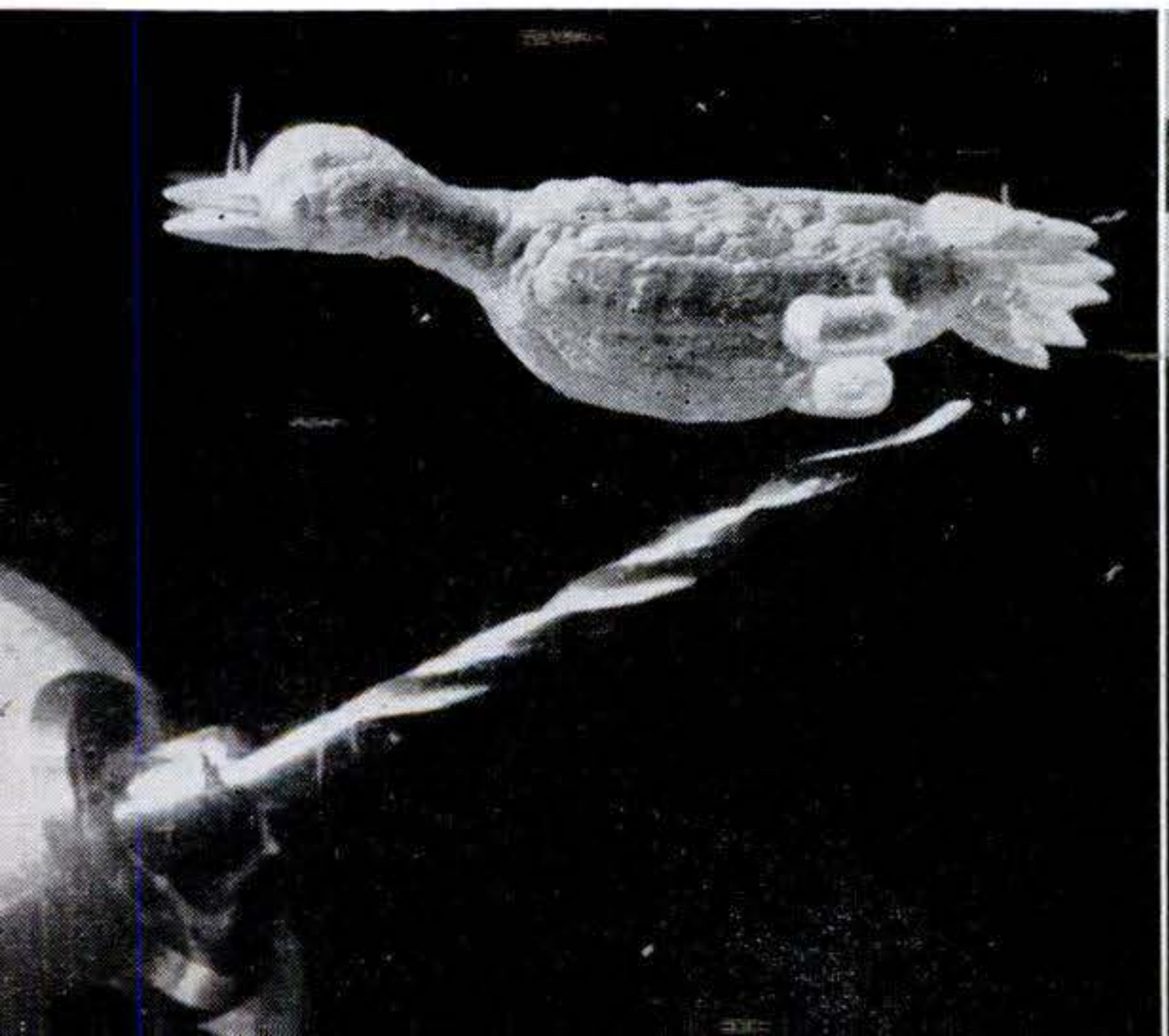
Wings are made with the spiral drill. Make the first thrust from wing root to wing tip. Withdraw the drill slightly, sweep it to one side, and push it forward to the next feather tip. By following this procedure, you'll get a curve in the wing. Make the tail the same way. The grass and cattails are carved with the spiral drill and small ball cutter.

Clean out all the chips and you're ready to color the carvings with cold-dip dyes or with lacquer or oil paint. With a toothpick, paint the bills yellow. Color the head a brilliant green and then make the white neckline. Next put on the golden brown bib of the chest. The feet also are this color. The body and underside of the wing tips are white with just a touch of light brown dye. If a color runs to an area where it isn't supposed to, you can erase by redrilling slightly.

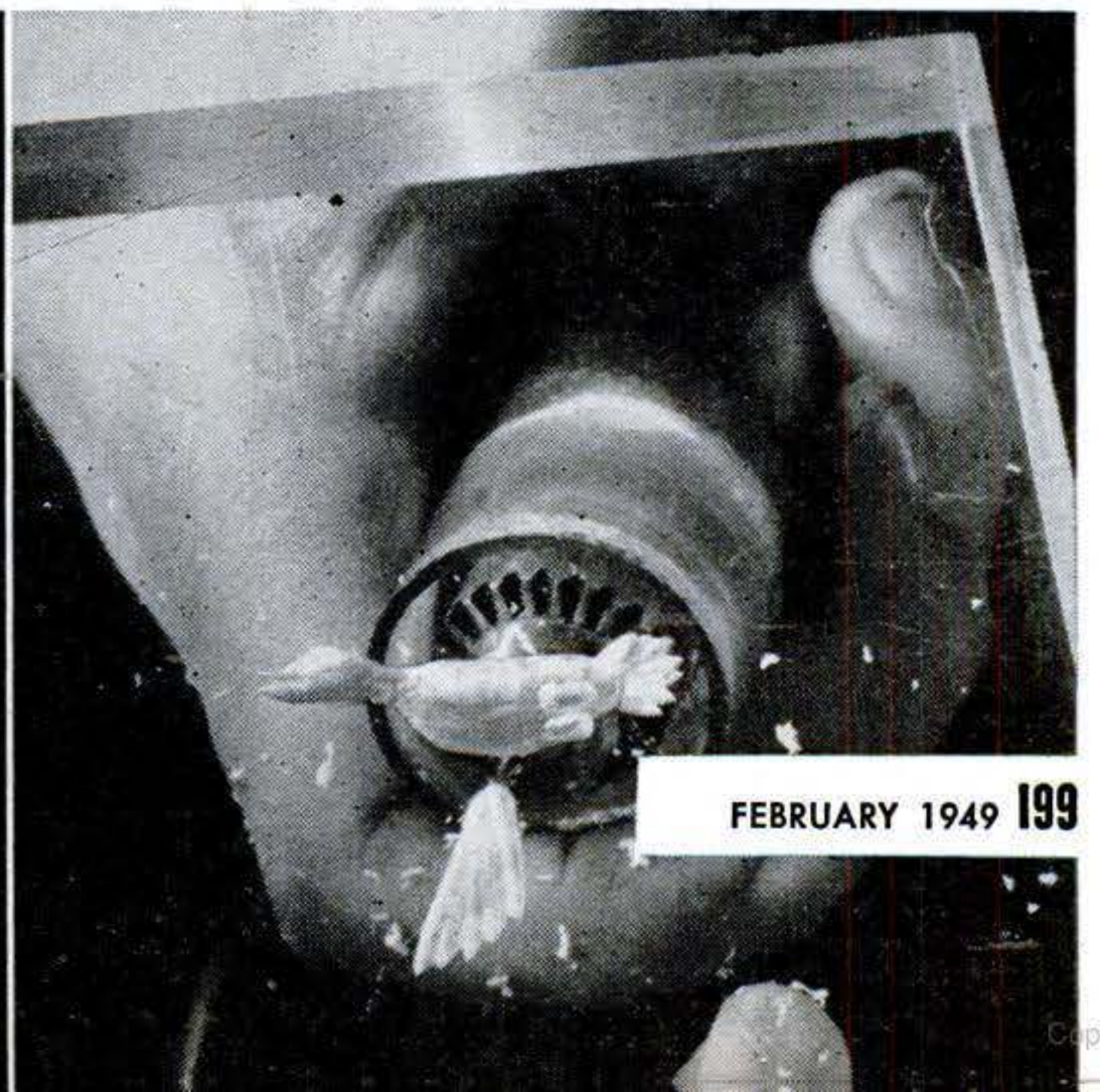
The frame of the lamp is ¼″ acrylic with the top clear and the sides and bottom opaque. A 45-deg. bevel on the edges of these pieces adds to the shadow box effect of the carving. A piece of clear acrylic 1″ by 7″ by 10½″ makes the base. The legs, beveled on all sides, are ¼″ by 1¼″ by 1½″.

Panels of translucent white acrylic form the shade. Cut all the slots in the interlapping lattice at the same time, preferably on

To make the tail, cut a point with the spiral drill, withdraw it slightly, sweep it to one side, and advance it to make the next point.



Wings are made in the same manner. Start at wing root and make a first thrust to wing tip. Withdraw, move drill aside, and repeat.



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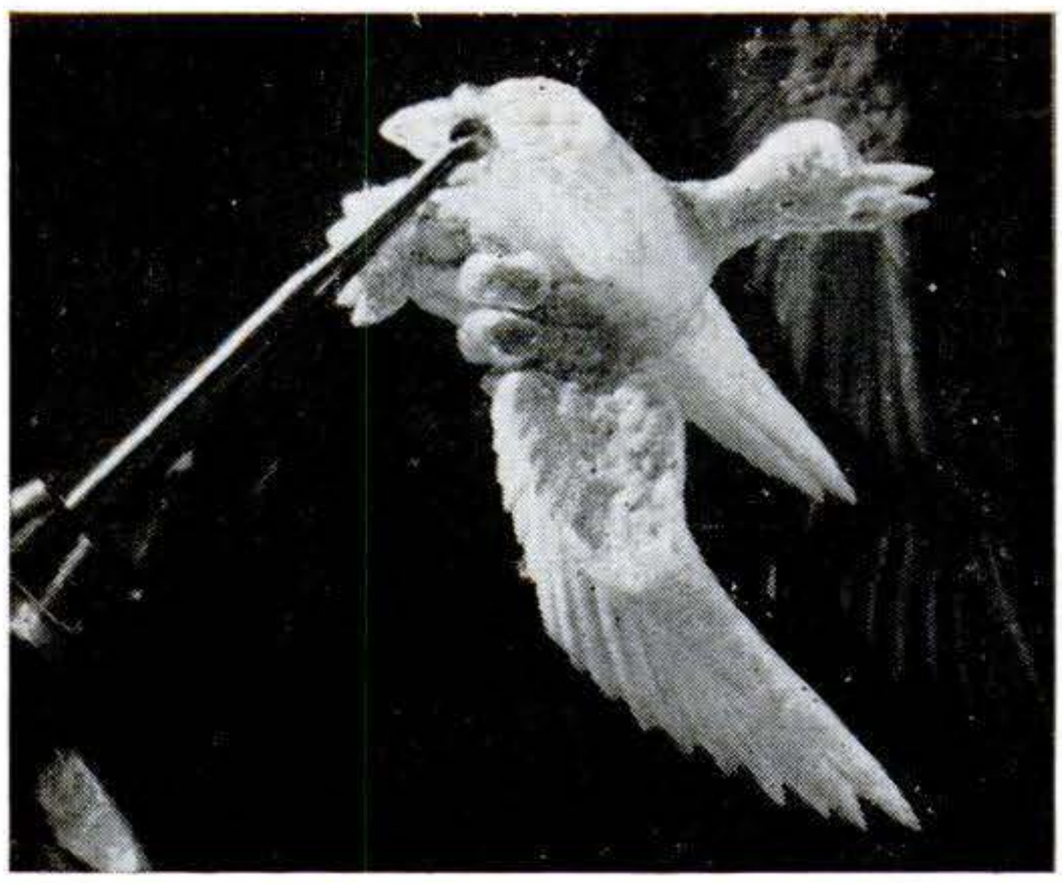
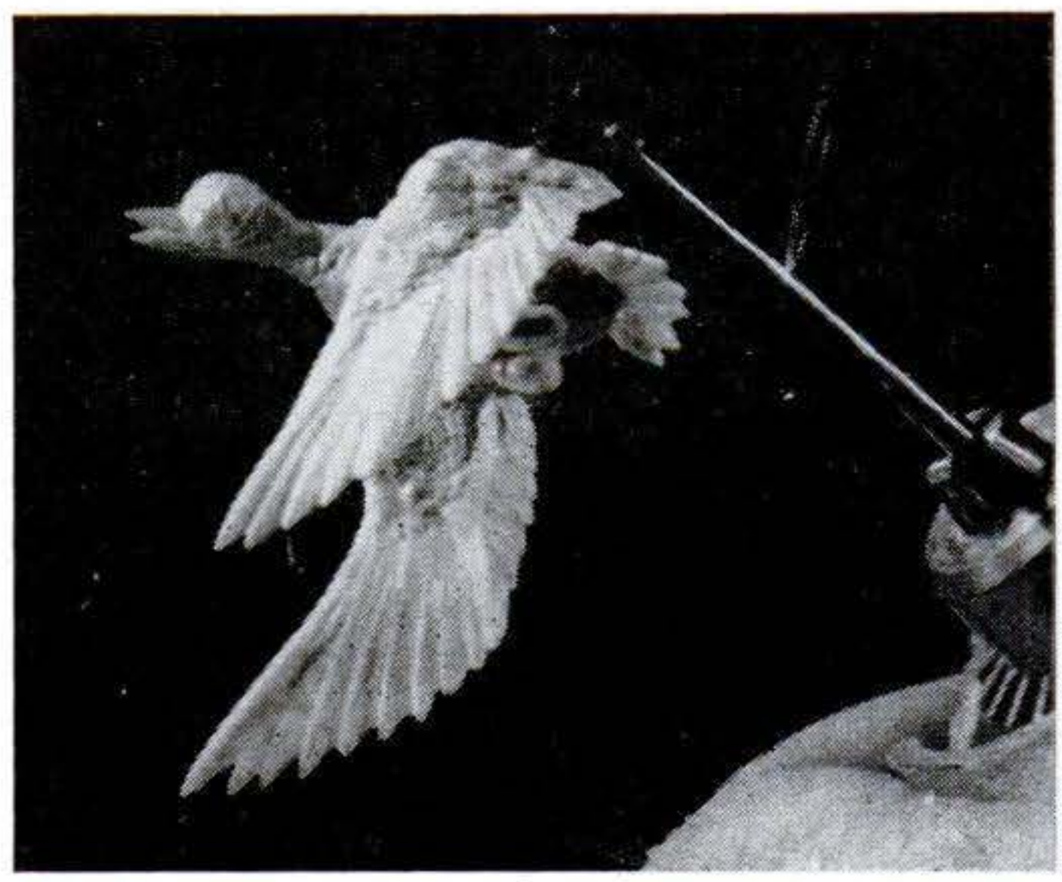
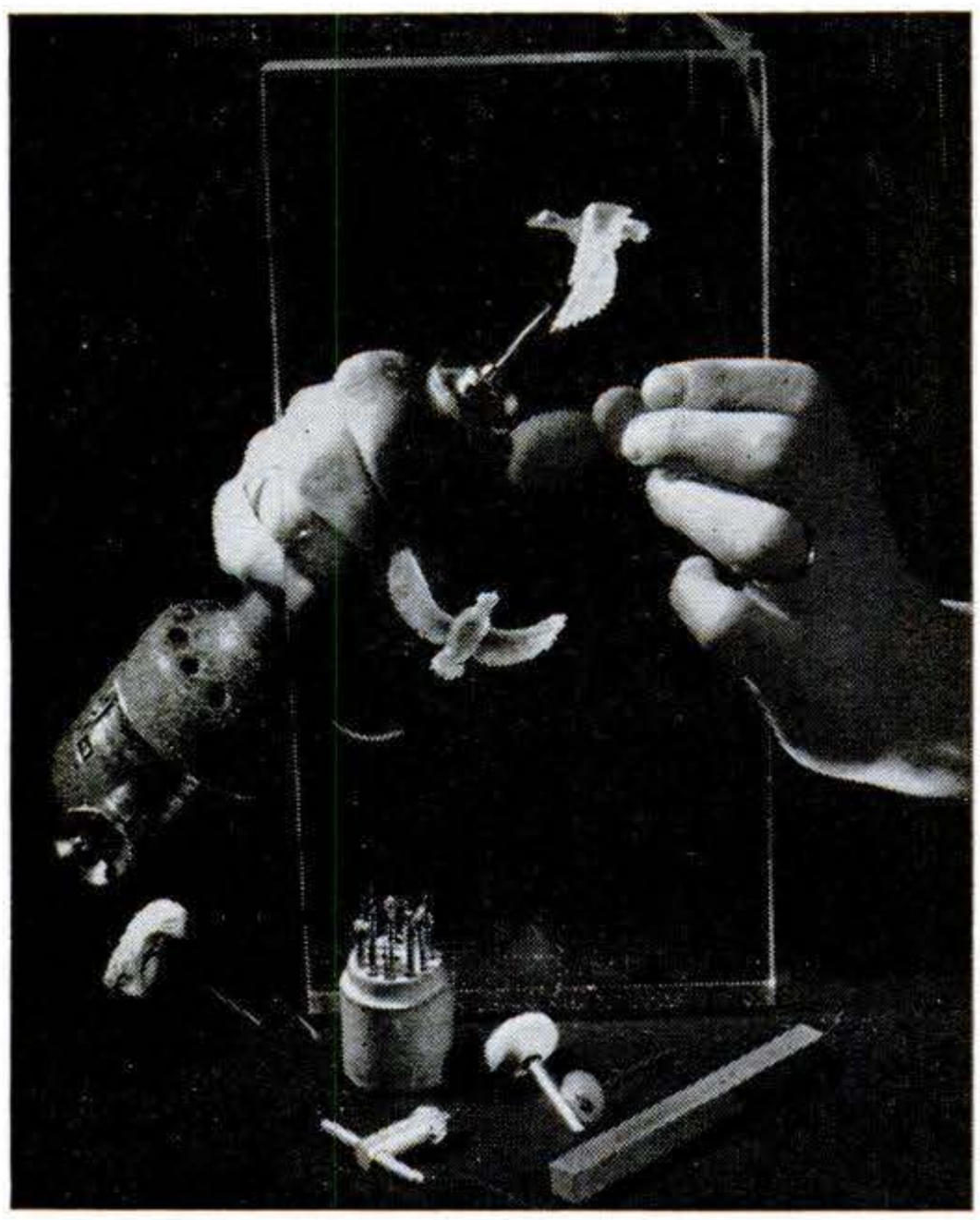


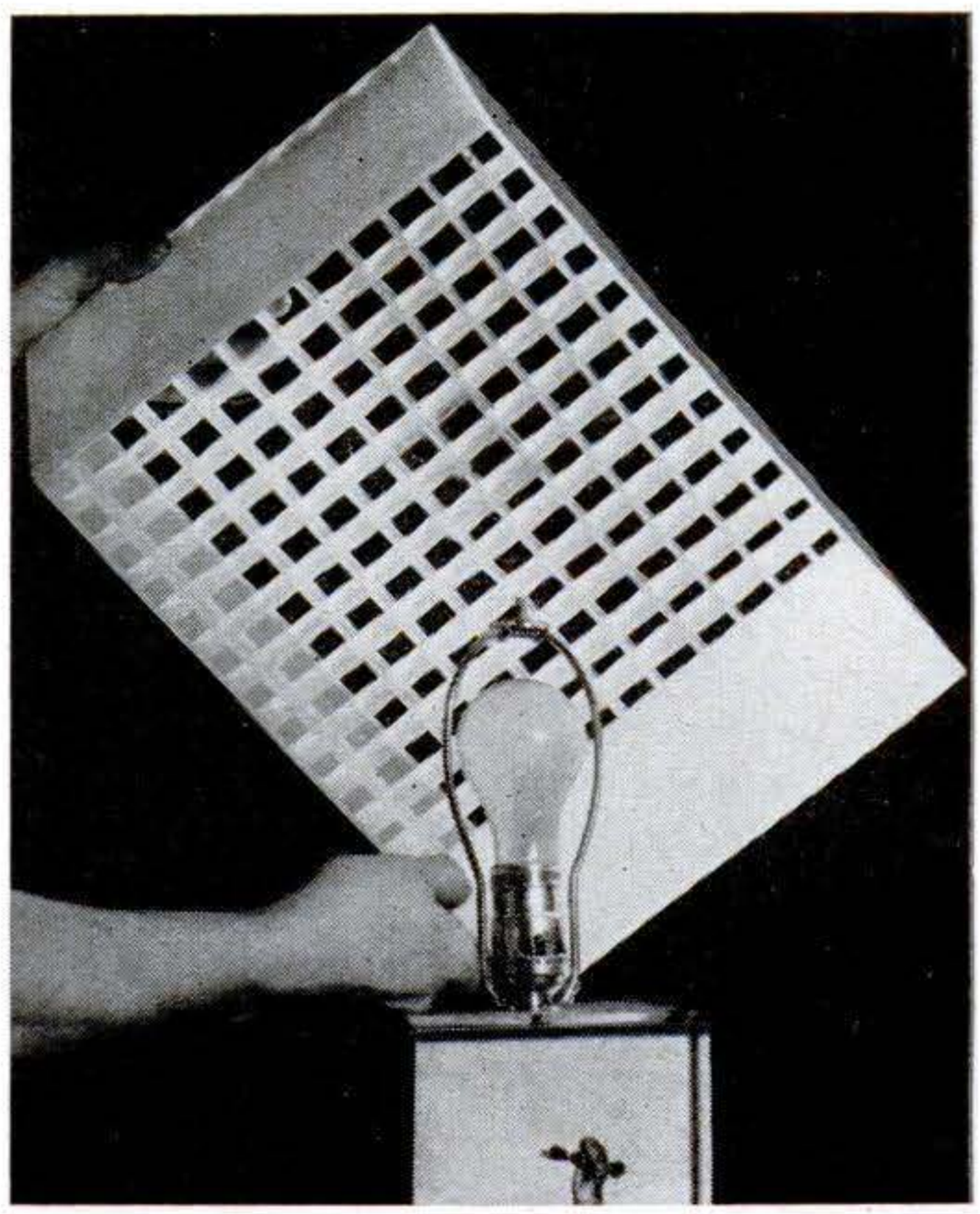
Although only straight cuts are made, the wings appear to curve. Drill is inserted, withdrawn, swung slightly, and again advanced.



After completing and coloring the carvings, fill in the cavities with dental plaster or one of the commercial compounds for this purpose.



When you've finished the mallards, carve the duck and ducklings and the swamp grass. Latter is cut with tapered drill and ball cutters.



A 2″ square of clear plastic ¼″ thick was drilled and tapped for a ¼″-20 thread and cemented under the lattice to take the harp.

a circular saw, so they'll line up and fit correctly. Assemble the four sides of the shade first and then cement the lattice in place. Drill and tap a ¼″ by 2″ by 2″ piece of clear plastic for a ¼″-20 thread. Then cement it to the underside of the lattice to take a standard lampshade harp.

For a background, I used a piece of cardboard with the swamp scene painted on it. If the lamp is to sit on a table by a wall, carvings in only one of the 1″ thick pieces of plastic will be sufficient. If the table is in the center of a room, carve both 1″ blocks and paint a background on both sides of the cardboard.

The bottom is drilled and tapped for the ⅛″ pipe that carries the wire. In assembling the lamp, put together the framework and then insert the background and carved blocks. The clamping action of the pipe nut beneath and socket above is enough to hold the lamp parts together. Finally, put a coat of protective wax on the entire project. This will protect its beauty and luster. END

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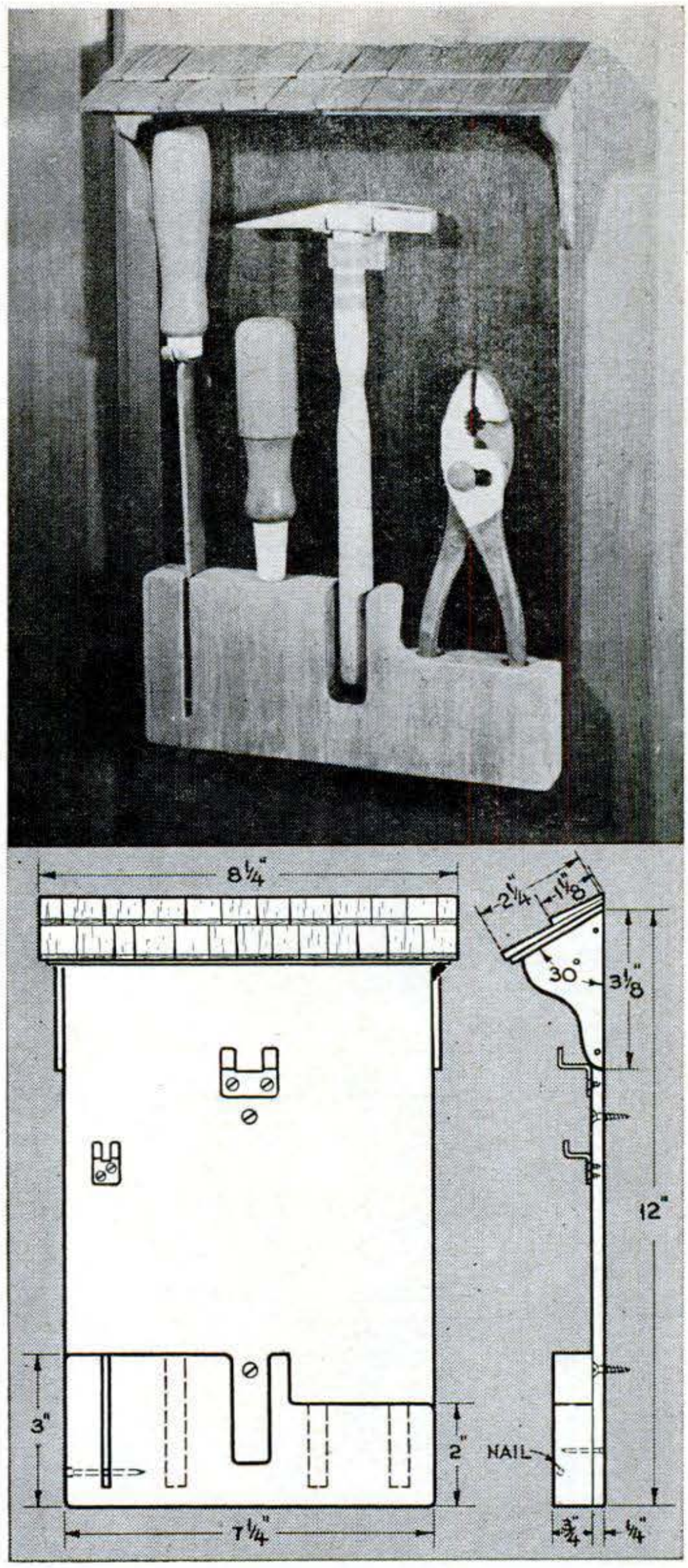
Rack Stores Household Tools

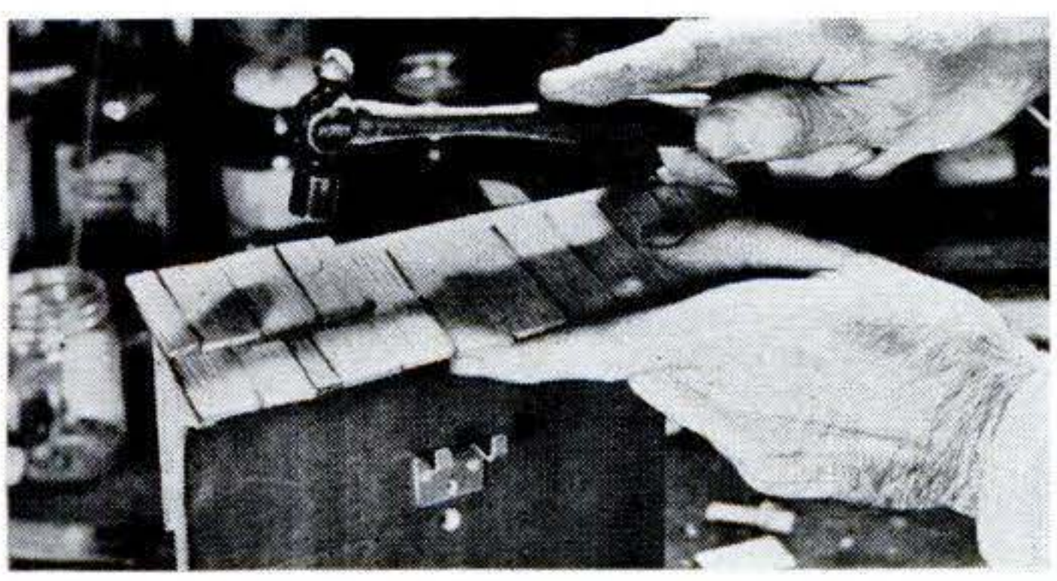
HAVING tools handy when and where you need them is almost half the work as far as the usual home repair job goes. With this rack—designed for the kitchen or pantry—four basic tools are always on deck when you want them. Although other tools may be added, a simple kit is more convenient, and the average man can make dozens of repairs with a hammer, file, screwdriver, and pliers.

The drawing gives you the dimensions to duplicate the rack pictured here. However, the figures aren't critical since the rack should be built to suit the tools. Slot the block at the bottom for the file and hammer handle and drill it for the screwdriver and pliers. If the clip that holds the file is shaped properly, you can do without the nail that retains the file blade. Clips can be cut and bent from sheet aluminum, or they can be pairs of nails or screws driven into the back panel.

Stain the shingles green and finish the other parts of the rack in colors that harmonize with the room where it is to be hung. —*Walter E. Burton, Akron, Ohio.*



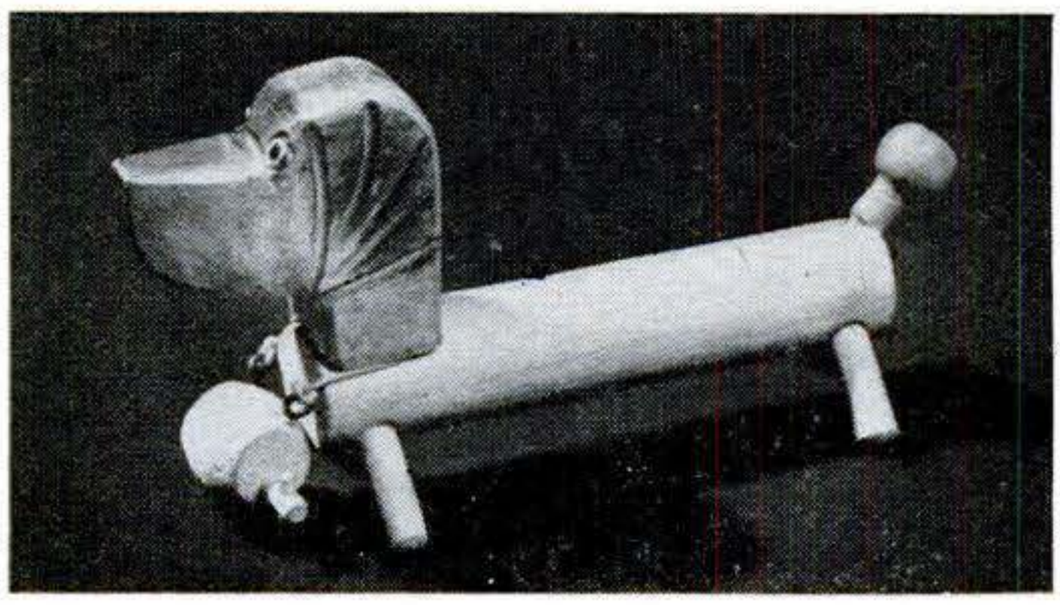
Rack is held to wall by two screws concealed by hammer handle. Block at bottom is secured by nails driven through the back panel.



Shingles are split from ¾" pine. They are ⅛" thick at outer end and tapered to 1/16" at the other. Fasten them with brads and glue.

Toy Dachshund Built from Old Umbrella Handle

PART of a broken umbrella handle, suitably carved, and a section of discarded shade roller form the head and body of this miniature dog, an amusing toy for a child. Holes were drilled in the roller for the dowels that make the legs. The tail is a decorative knob off an old chair. Another piece of roller was cut to simulate the cask under the dog's neck. The spigot is a piece of matchstick.—*Robert Ennis, Jamaica, N. Y.*



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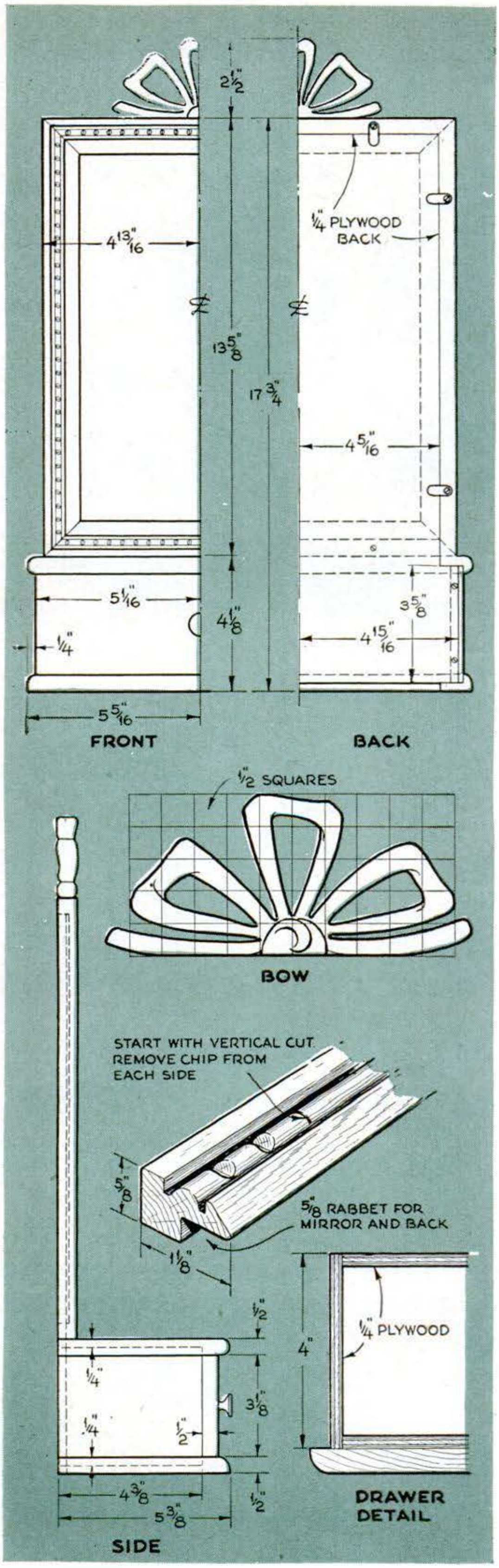

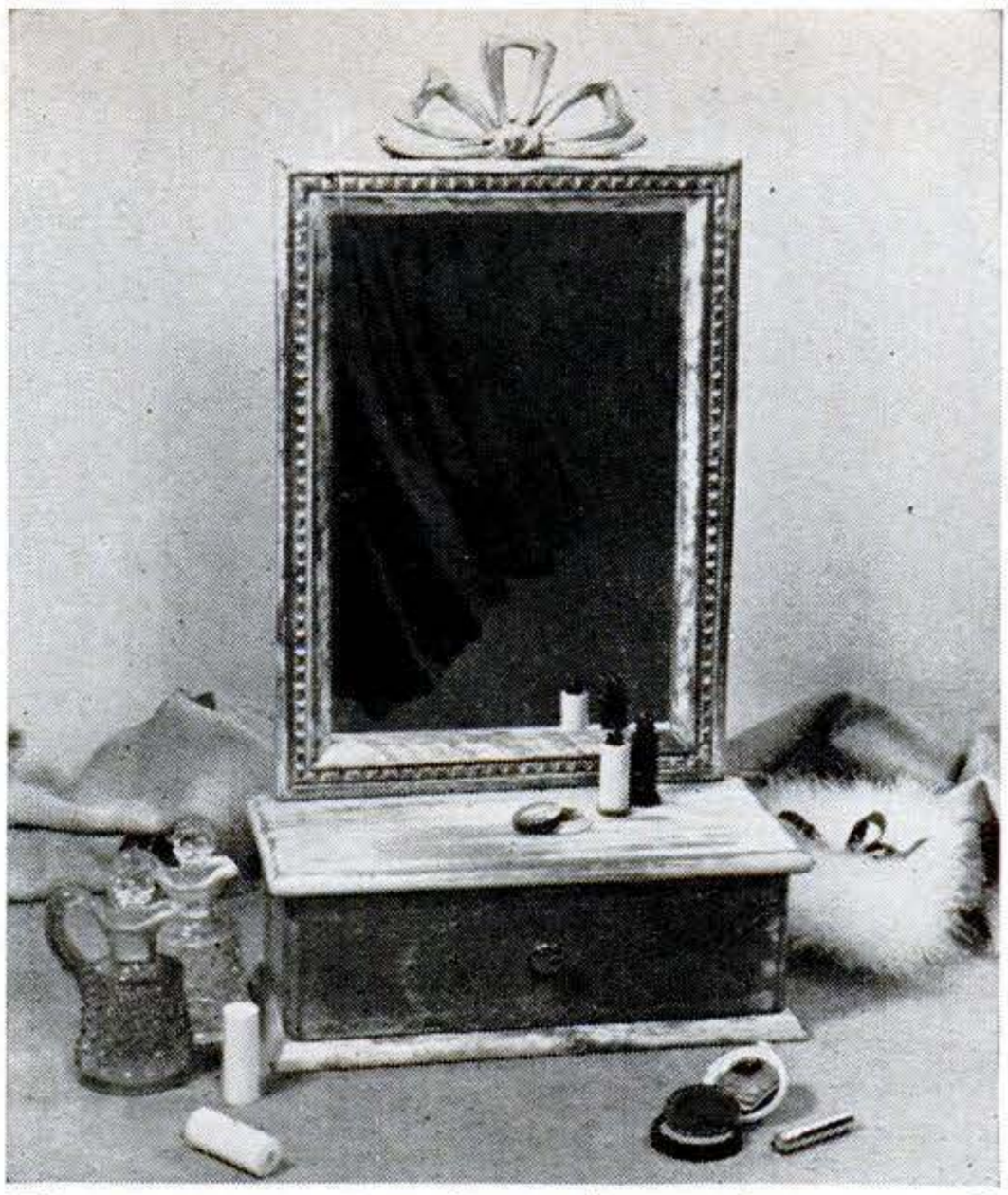

This cosmetic chest has a drawer large enough to contain a variety of dressing-table needs.

Make-up Mirror Shows Good Craftsmanship

ATTENTION to detail counts in this small and very personal make-up chest, for the lady who gets it will have plenty of opportunity to study it at close range. The piece shown is made of mahogany.

All the frame dimensions given in the drawing are based on a mirror measuring 8½″ by 12½″. If you can't conveniently get one exactly this size, alter the specifications.

Start by cutting the top and bottom of the chest and drawer front from ½″ stock. Round the edges as shown. Cut ¼″ by ⅜″ by 4⅜″ stop dadoes in the top and bottom pieces to receive the ⅜″ side panels.

A single piece of plywood forms the back of both the mirror and chest. To make it fit flush, the top and bottom of the chest are cut back, as seen in one photo, and the side panels are rabbeted ¼″ by ¼″. Assemble the case with glue and wood screws.

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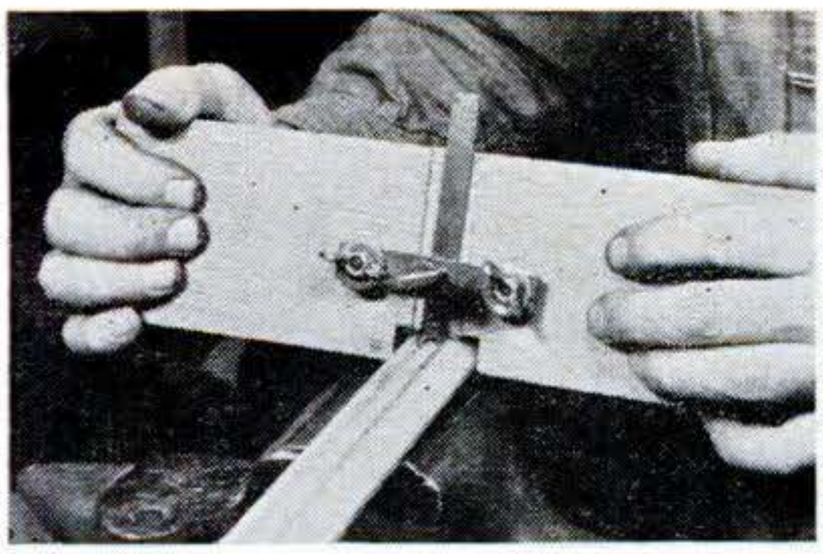
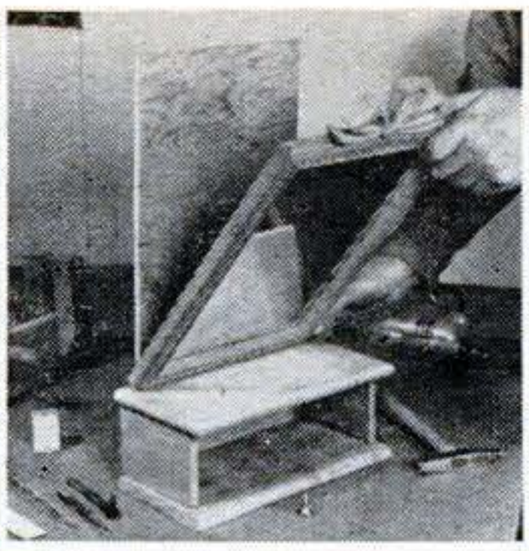
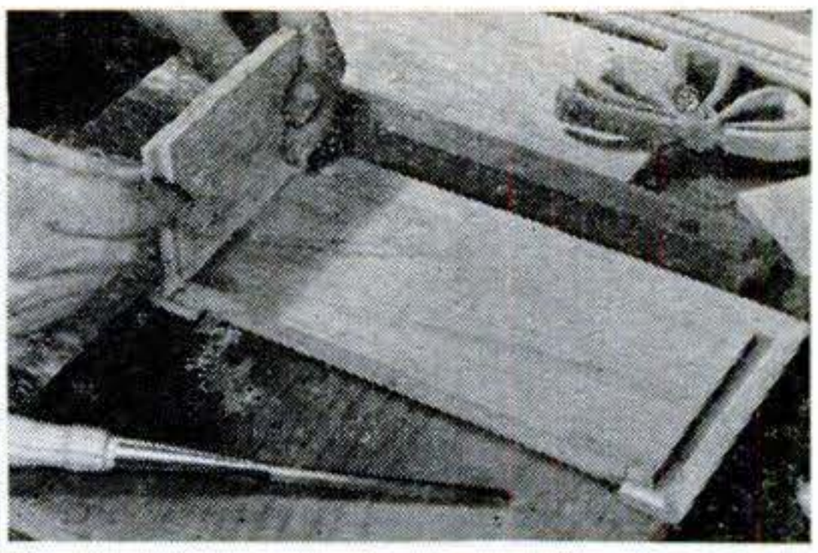






A scratch block for shaping the molding can be made as at left. The steel cutter is ground or filed to a reverse profile of the desired grooves. When the chest and back are assembled, the rabbeted mirror frame (center) is slipped onto the plywood back. Right: Side-pieces are fitted into stop dadoes cut in the top and bottom (top shown) of the drawer case.

Molding is made from ⅝″ by 1⅛″ strips. Chamfer the inner edges first, and then make the grooves. If you don't have a shaper or drill-press shaping attachment, use either a combination plane or a scratch block. The latter consists of a notched board to which a steel cutter has been fastened. Take light cuts, drawing the scratch block toward you. Lower the iron as necessary.

A ⅝″ rabbet deep enough to accommodate the ¼″ plywood back and the mirror glass is cut on the inside edge of the molding. The strip is then sawed to length. Glue and nail the mitered corners. Jigsaw, whittle, and file the bow for the top of the frame from ¾″ stock. Fasten it with glue and a countersunk flathead wood screw through the frame rabbet.

An appropriate finish of white gesso paint can be compounded of ¼ cup flaked or powdered glue dissolved in 2 cups hot water. Add whiting to make a creamy mixture. Brush the paint on and partially wipe it off to allow some of the color and grain of the wood to show. Polish with paste wax. —*Doris Aller, San Francisco.*

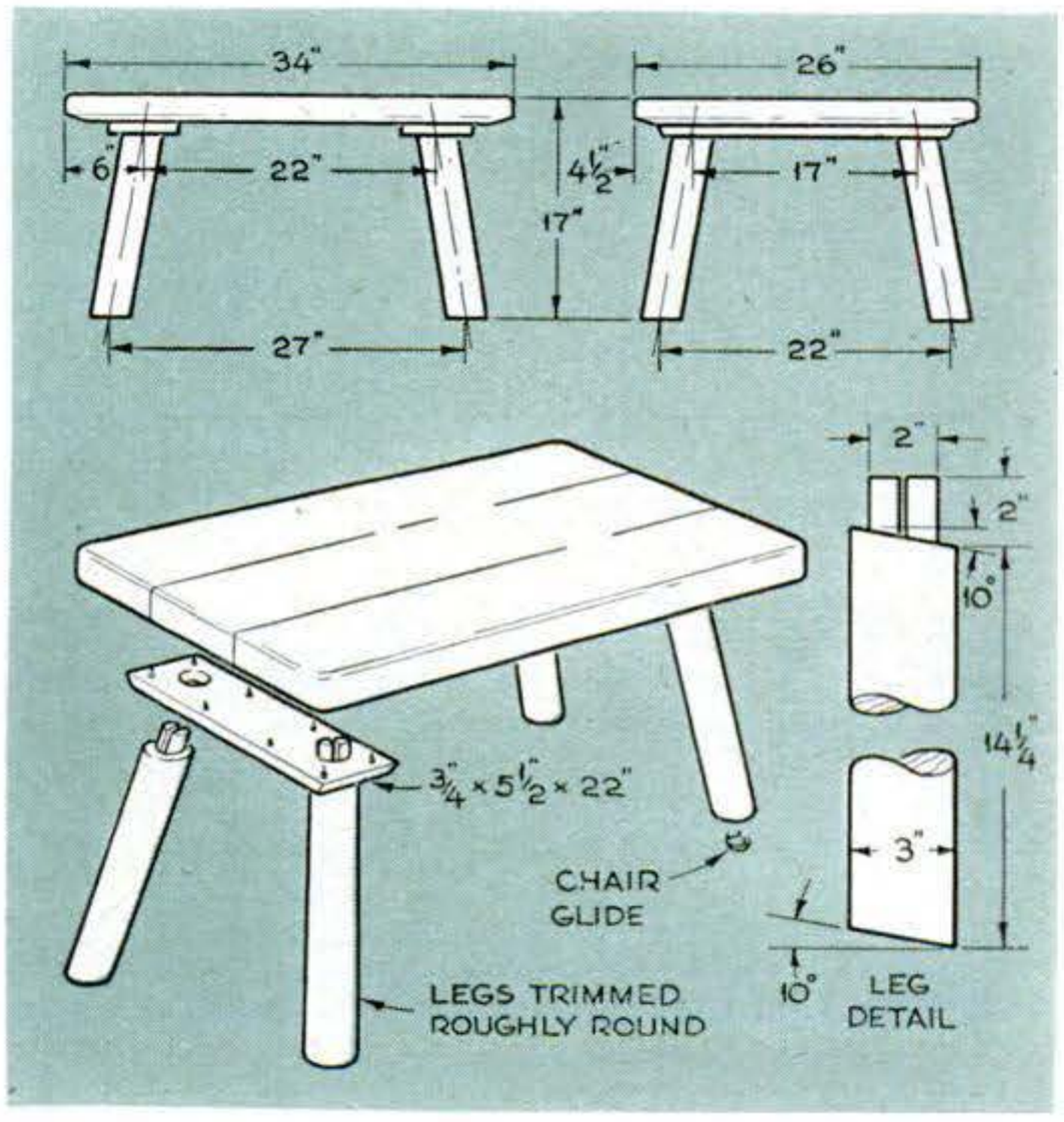
Rough-Hewn Coffee Table Is Made by Hand

THE hand-crafted look adds to the attractiveness of this exceptionally sturdy coffee table. No power tools were used in its construction. The 26″ width of the 2″ thick top is made up of two 8½″ outer planks and a 9″ center one. Edges are planed smooth, doweled, and glued together. The top is carefully surfaced with plane and sandpaper.

Two cleats are secured to the underside with lag screws. Bore 2″ holes, angled 10 deg. off the perpendicular, in the cleats for the leg dowels. The latter are slotted with a saw for hardwood wedges.

Legs are made of 3″ square oak. Offset the shoulders to achieve the proper slant, and trim the legs roughly round. Coat the tenons with glue, insert the wedges and tap the legs home.—*Hi Sibley, Nuevo, Calif.*

Planks for the top of this coffee table were split from a seasoned 10″ by 10″ pine timber.



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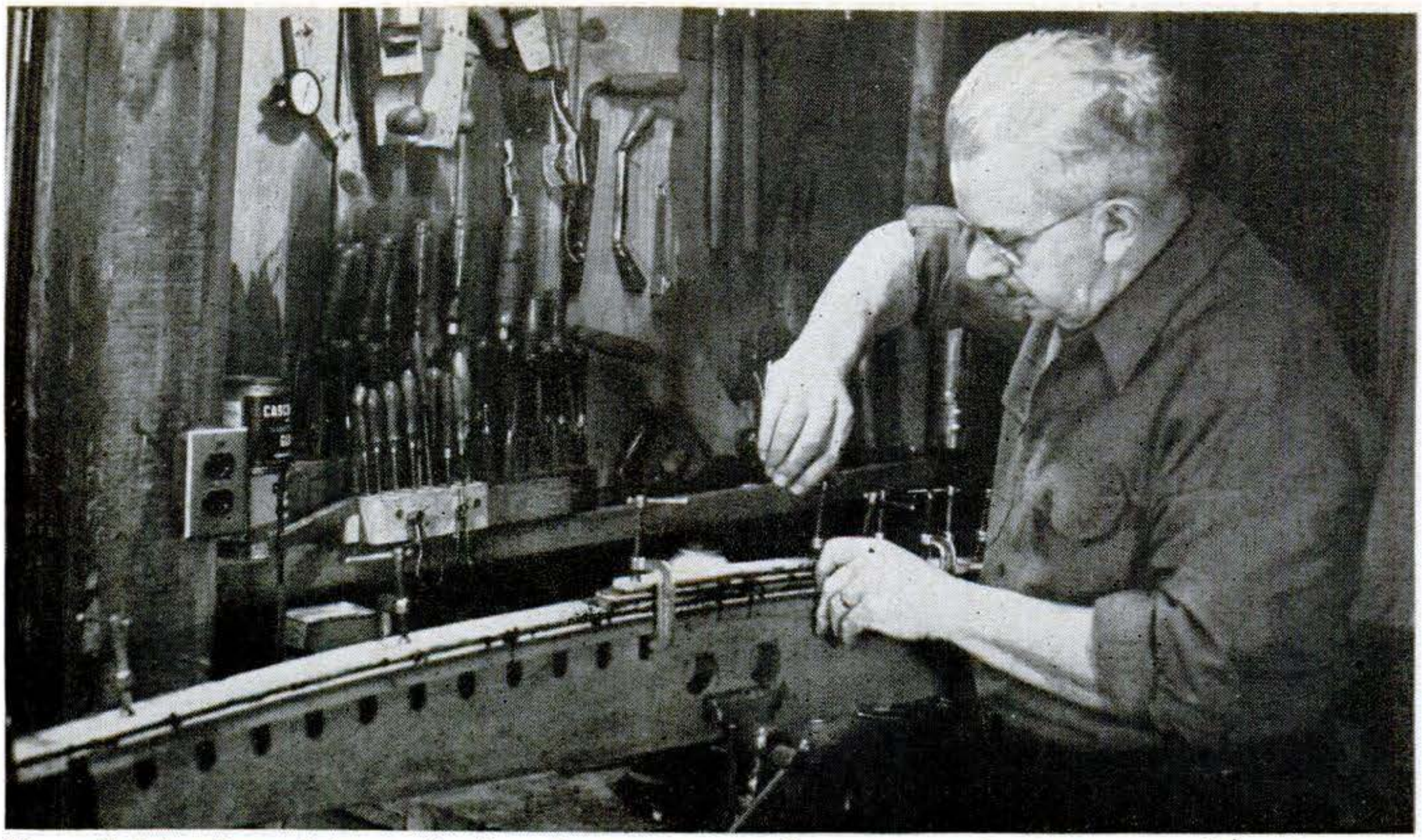


Powerful laminated bows for hunting or target shooting are built in a jig like this one.

How to Make Laminated Bows

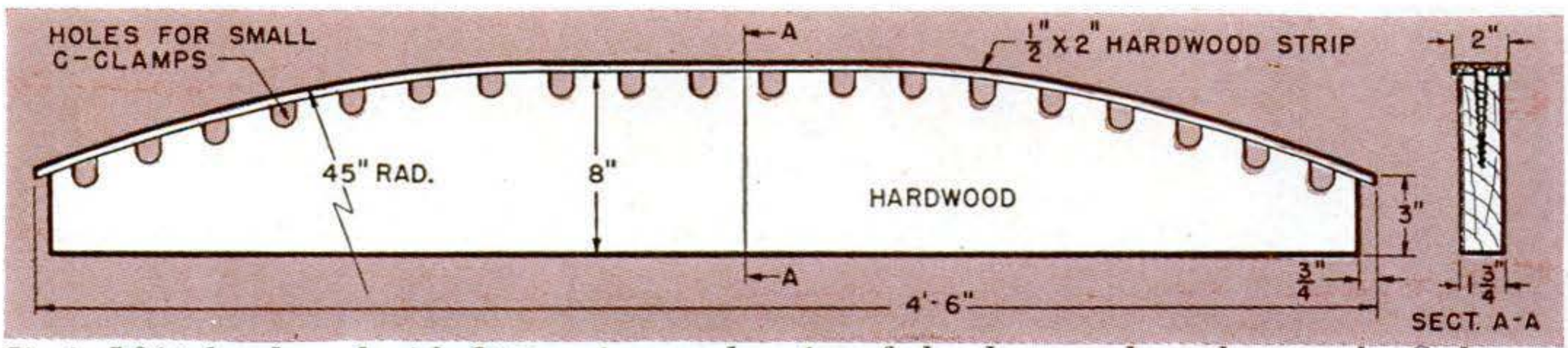
LAYER-BUILT bows—streamlined, hard-hitting, and almost unbreakable—are coming into wider use by both hunting and target archers. These bows, glued up in a jig, use various woods, and sometimes other materials such as horn, fiber, or plastic.

Hickory usually goes into the back layer because of its tensile strength, although bamboo sometimes is used. The center lamination does very little work. It mostly provides stiffness. A popular choice for this layer is yew or walnut. For the belly layer—the string side of the bow—osage orange is preferred by most bowmen.

For the heavy, short bow favored by hunters, a ⅛″ layer each of hickory and yew and a 3/16″ layer of osage orange is a good combination. All three laminating strips, plus several short strips for the handle riser, are coated with glue, assembled, and clamped in the jig at the same time.

Tracy L. Stalker, of Flint, Mich., who designed the jig shown at the bottom of this page, uses a resorcinol-type glue. It's strong, waterproof, and gives ample time to assemble the strips. Depending on the room temperature, you can allow from 15 to 30 minutes between the time this glue is applied and the clamps are tightened. The warmer the room, the quicker the glue sets.

Although bows usually are of wood, a powerful composite bow of horn and wood has long been used in Asia. A bow of this type is on record as shooting an arrow 482 yards. However, horn is difficult to use and a composition of compressed wood and plastic has been developed as a substitute. It



Jig is 1¾″ hardwood with 2″ toppiece and series of closely spaced notches to take C-clamps.

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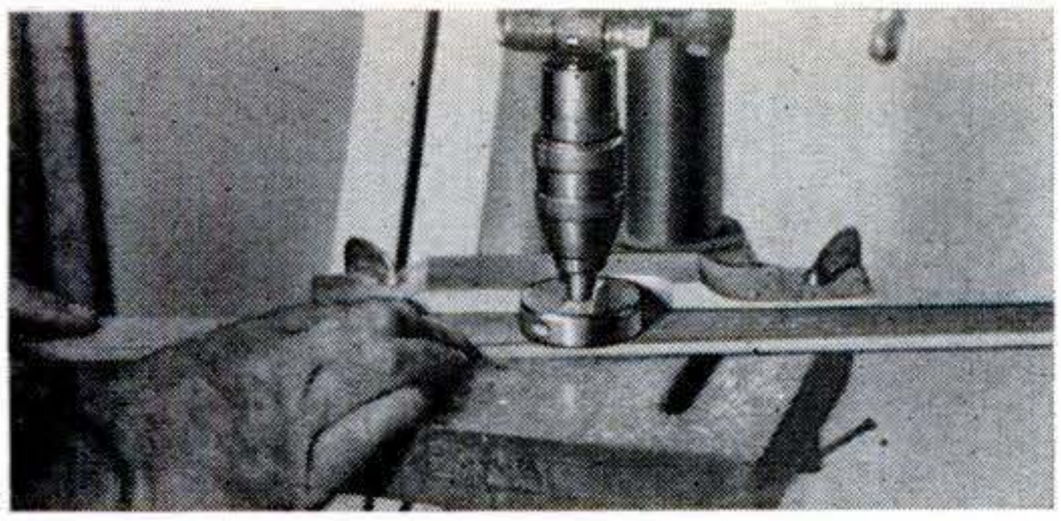
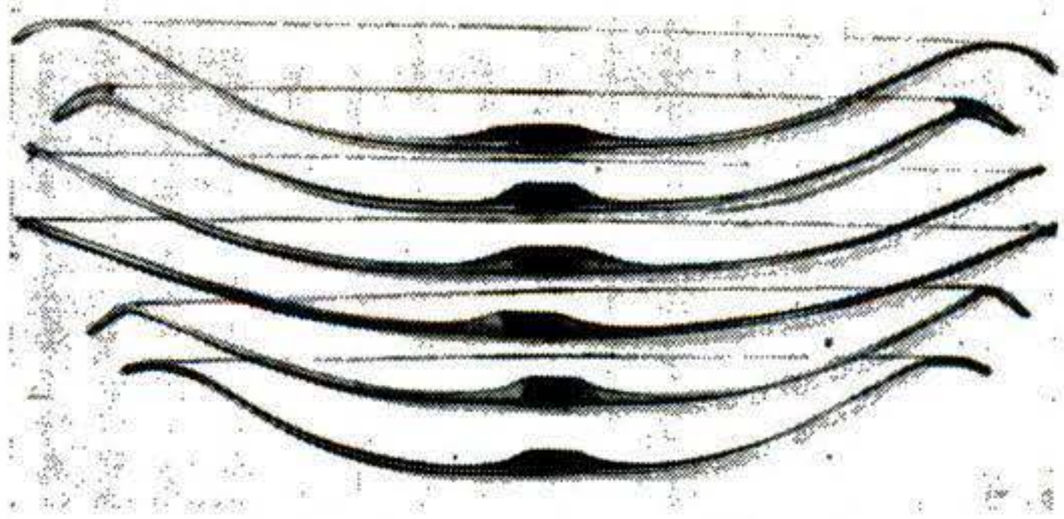


Laminating strips must be true and flat or unsightly glue joints will result. Above, a strip is leveled with rotary planer in a drill press.

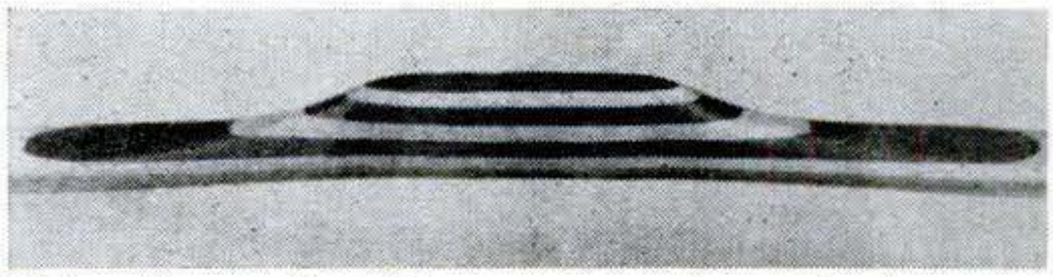


Six typical laminated bows. The fourth one from the top was built up of a fiber back and 10 thin laminations of lemonwood.

will add as much as 30 pounds to the drawing pull of a 5′ bow with limbs 1½″ wide. This facing is glued to the belly while the bow is clamped in a reflexed position.

Another way to improve the cast of a bow is to glue a strip of hickory to the back. Use a piece of hickory as wide and as long as the bow and from 3/32″ to 5/32″ thick. After sanding the wood and applying the glue, clamp the bow and backing strip in the jig in a reflexed position. Bows glued up while reflexed tend to bend backward when unstrung. Then when they are strung, they are in a high state of stress even before an arrow is drawn. This gives them their power.

When gluing up bows or when adding a strip, first clamp each limb lightly at the end and in the center. Leave these clamps loose enough so the strips can adjust themselves as the clamps are tightened. After the first three clamps, start at the handle or center and apply clamps toward each end. Tighten them until all excess glue is squeezed out.



This shows handle construction of alternate layers of walnut and maple. These are glued-up with the bow and later rounded off.

Leave the bow in the jig for at least 10 hours if the temperature is about 70 deg. A good test is to note whether the squeezed-out glue is hard. The joint then is generally cured enough for handling, and the bow can be finished.

Pictorial Greeting Card Decorates Humidor

VALENTINE, birthday, Christmas, and other greeting cards will convert an old cigar box into a handsome humidor, or change squares of cork to distinctive coasters.

Cedar cigar boxes are best for the humidor. Sand down the imprinting on the sides or glue oblong panels over it. Cut the panels from the thin separators found in the box. Center the card and outline it on the lid. Then chisel away the outlined area deep enough to take the card and a cover of window glass. Make the coasters the same way from squares of cork. Rubber cement will hold the cards in place on the box or coasters.

Chisel out a section for the card and then sand it smooth so the card fits flatly. Next, as in center photo, anchor the card with rubber cement. Cut a piece of window glass to fit tightly and ease it into place. As the final step, apply a walnut stain to the box and wipe it off to get the desired shade. Polishing with furniture wax and cloth will give the humidor a high gloss.

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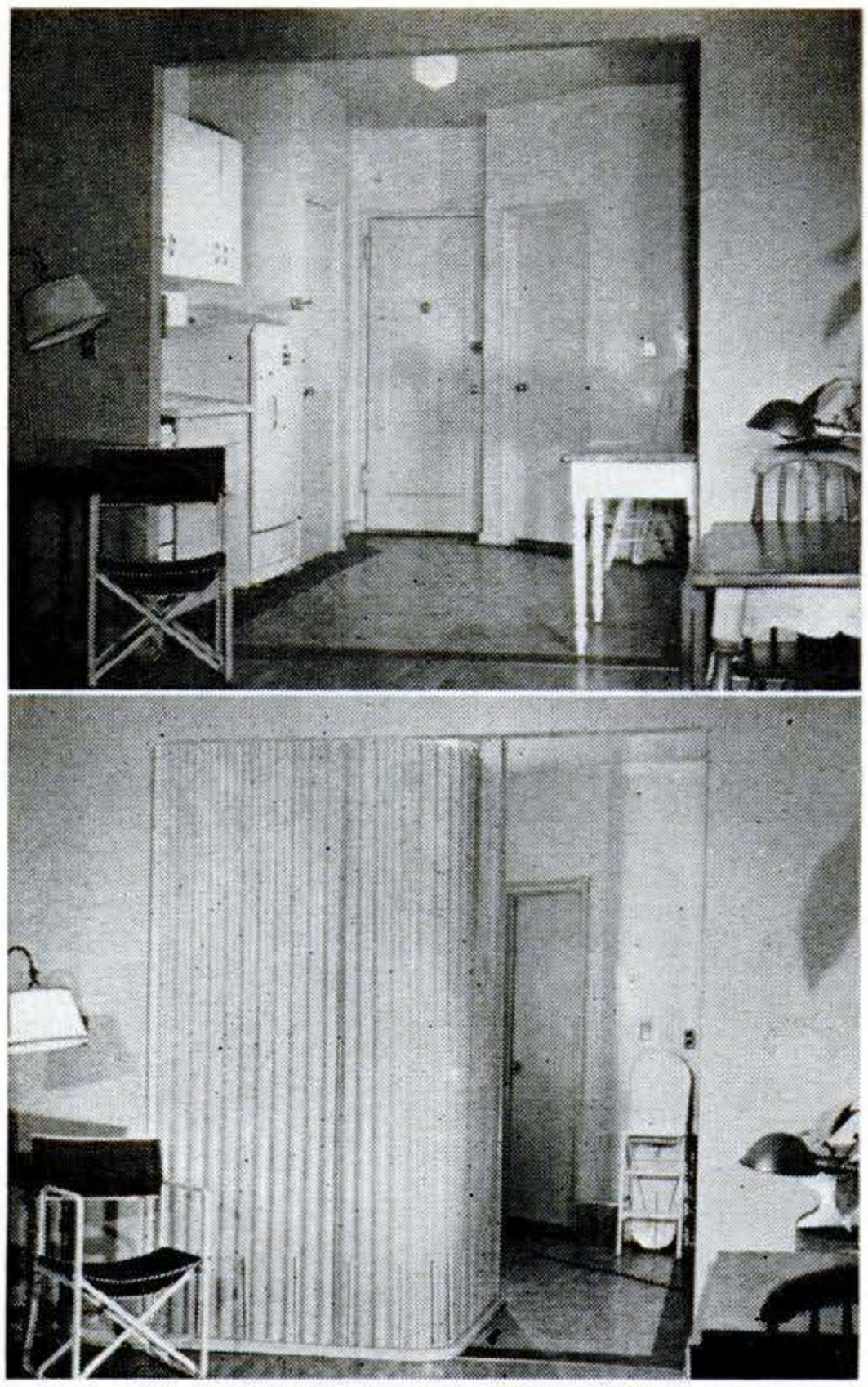
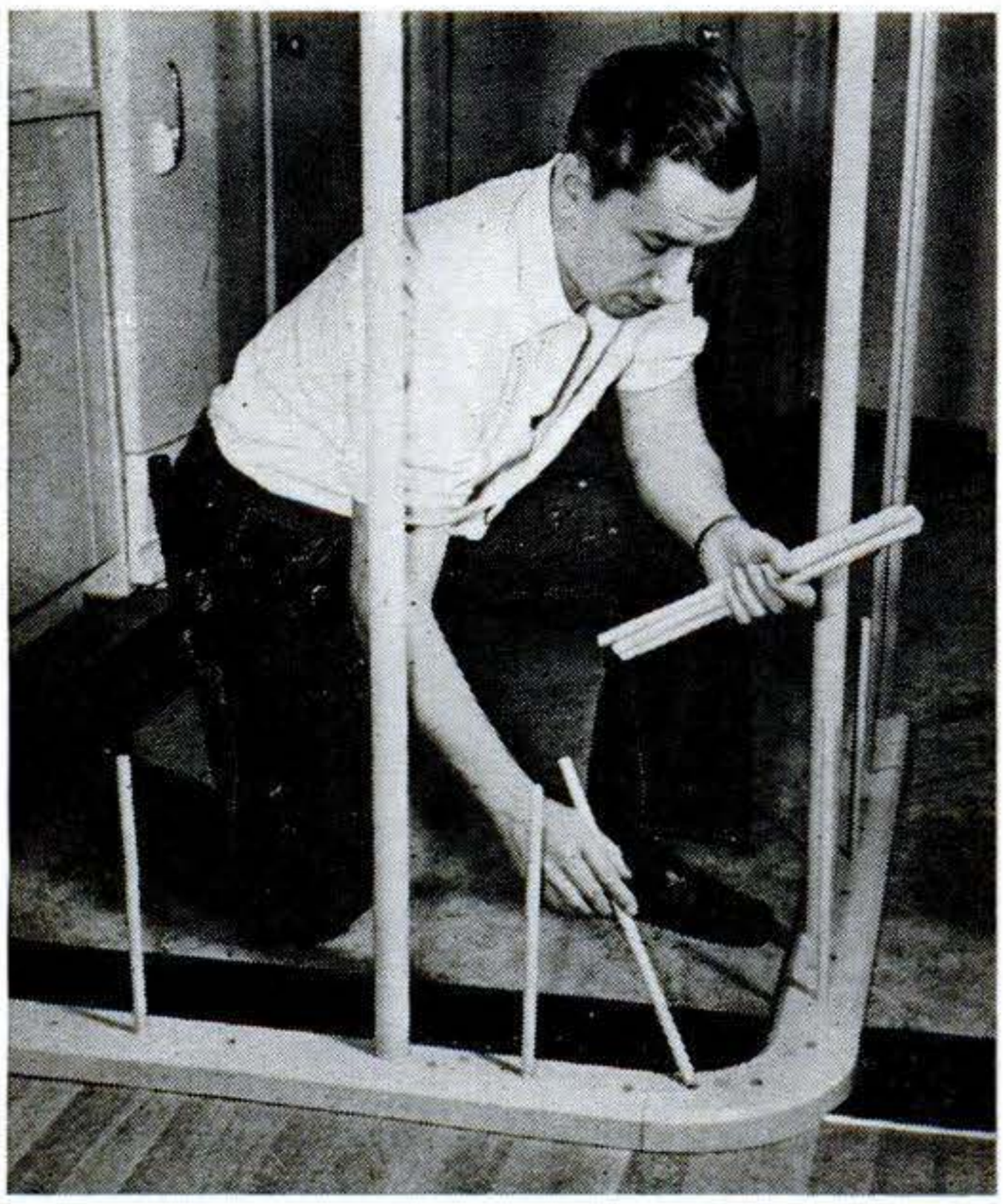


Using Flexible Glass in Your Home

ONE of the newest structural materials to hit the market looks like colored corrugated glass, and yet it is light, flexible, and transmits light and air but blocks vision. Called Prest-Glass ®, it has dozens of uses around the house. With it you can build partitions, design radiator covers or light fixtures, or face old desks or cabinets to give them a bright, new look.

A combination of Fiberglas ® and a thermosetting resin, the porous, translucent material is formed into 8′ sheets that weigh about 7 lb. per 1/16″ panel. It is available in more than a dozen colors and three corrugations: 5/16″, ⅝″, and 1½″. The smallest is recommended for lampshades, waste-

Curved partition in small apartment fences off kitchenette and creates short hallway. Top photo shows original setup; lower, the partition.



Dowels on both sides of the panels hold the bottom in line on the beveled 2″ by 4″ base. The 1⅜″ supporting poles also fit into the base.

Edges of panels fit into grooves in each end pole. Wood screws hold panels to other two poles. Angle brackets secure poles at top.

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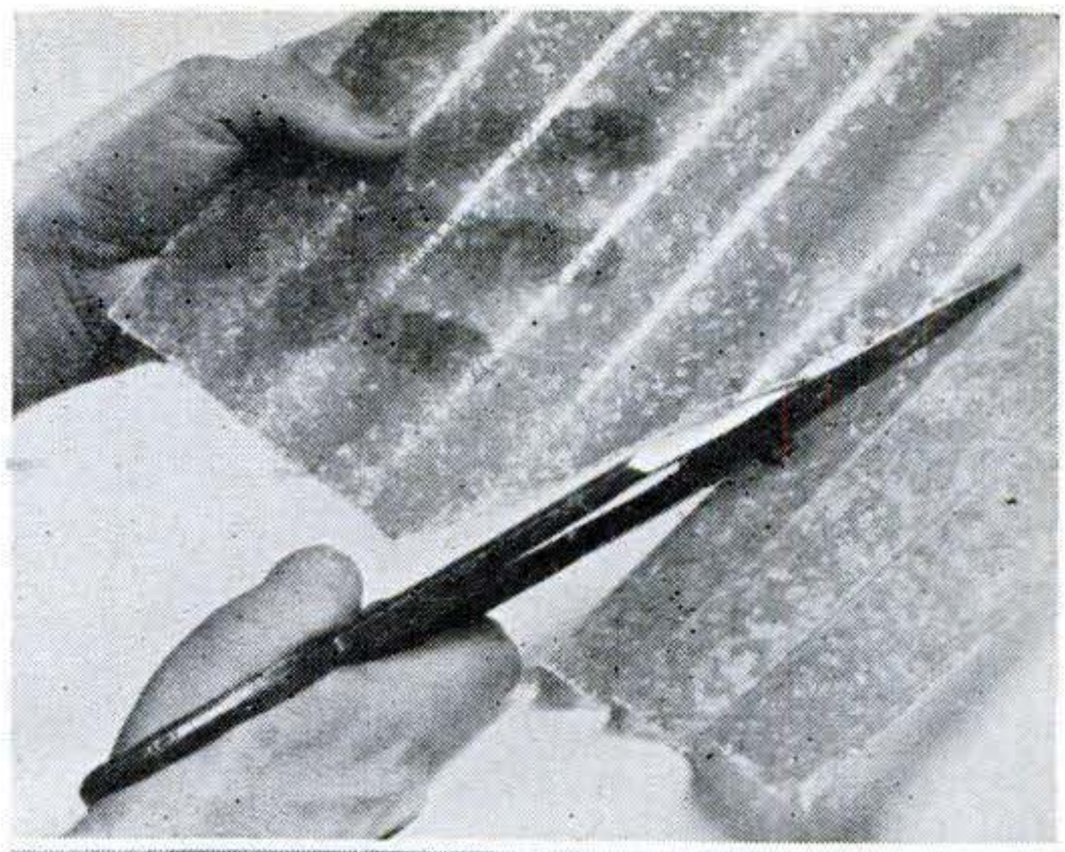
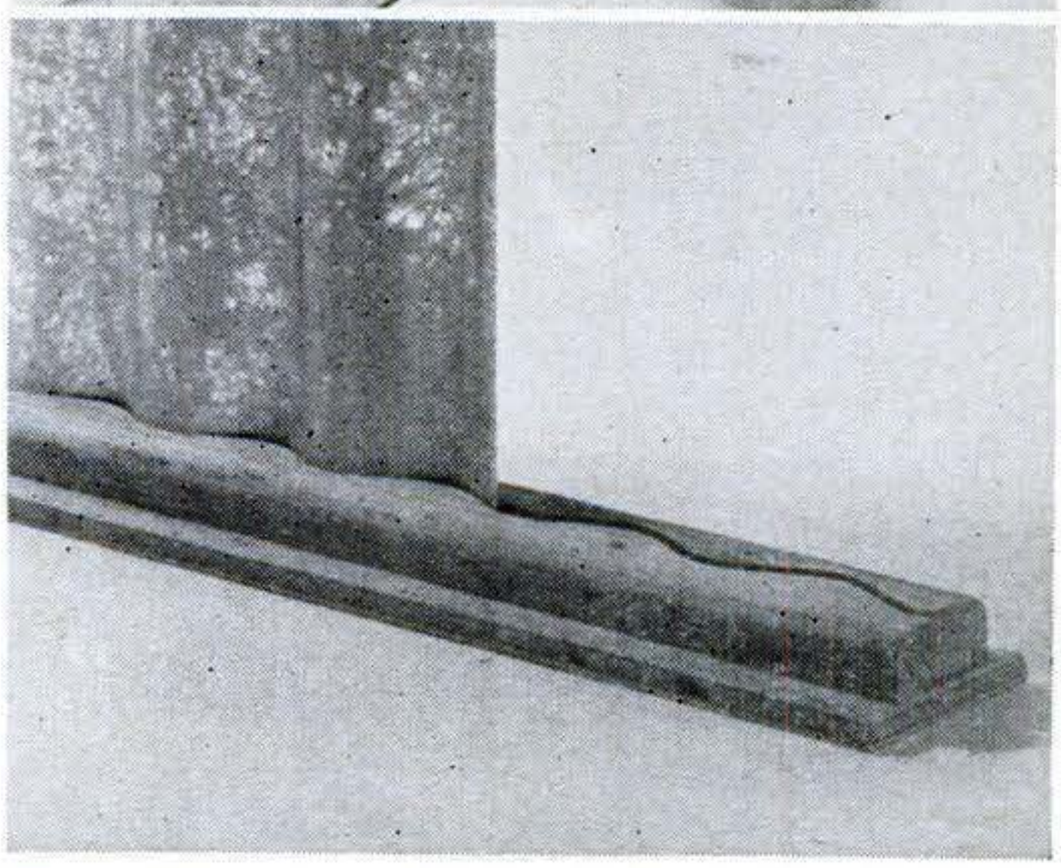
baskets, screens, door panels, and radiator enclosures. Depending on the depth of the corrugation, the panels come in three widths: 24″, 30″, and 32″. Its biggest drawback at present is cost, which is 75 cents a square foot and up, figured on area before corrugation.

Because of its lightness and tensile strength (23,000 lb. per sq. in.) this material needs no heavy supporting framework, and construction is consequently fast. It can be nailed, drilled, punched, and cemented. Sheets can be cut to size with ordinary tin snips. Although it is rigid in the direction of the corrugations, Prest-Glass is flexible across the panels. It can readily be formed into columns or shaped to fit curved surfaces. Released from a curve, it springs back to its original shape.

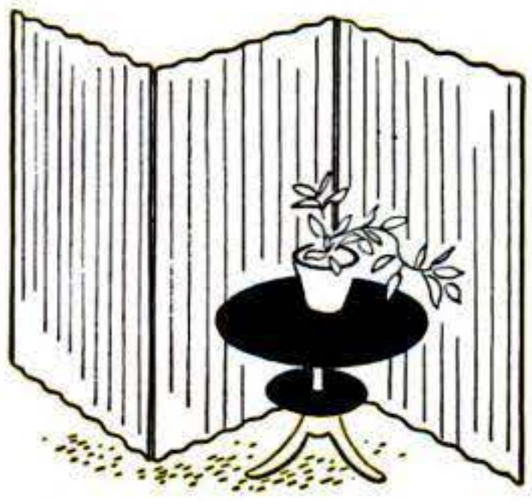
Colors do not change or lose brilliance even after prolonged exposure to sunlight, salt water, or high temperatures. It will not soften or change up to 350 deg. F. and is rated in fire tests as a self-extinguishing material. The glass has a high resistance to moisture and will not shrink or warp.

A few suggested uses are sketched below. An obvious one, of course, is using it to panel the walls and ceiling of a room, or using it as a wall of an outdoor dining room. Since it is weather resistant, it may be used either indoors or out.

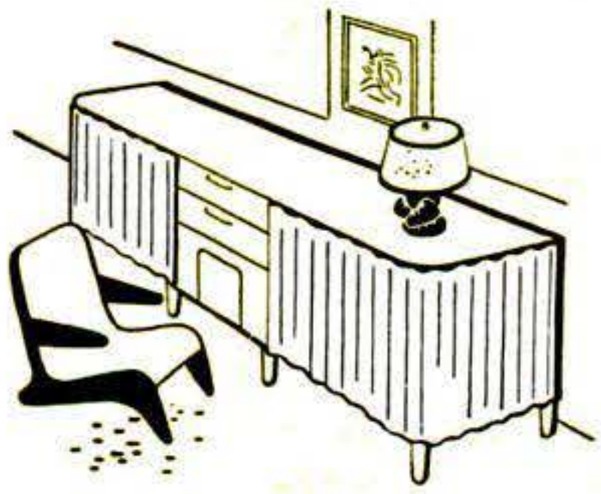




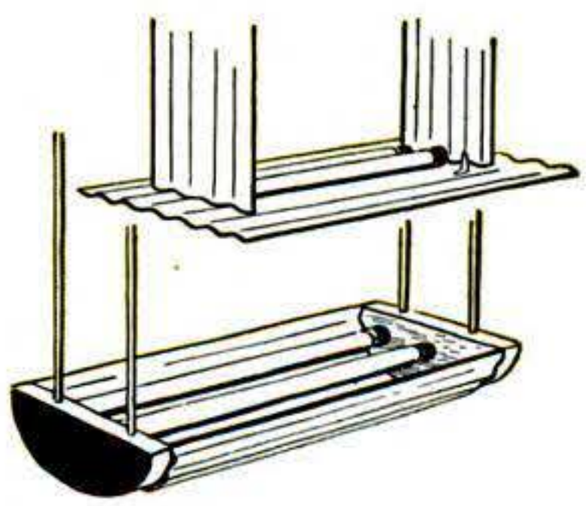
Prest-Glass® can be cut to shape with tin snips. Molding shown in lower photo was cut out on a bandsaw and nailed to the flat base.



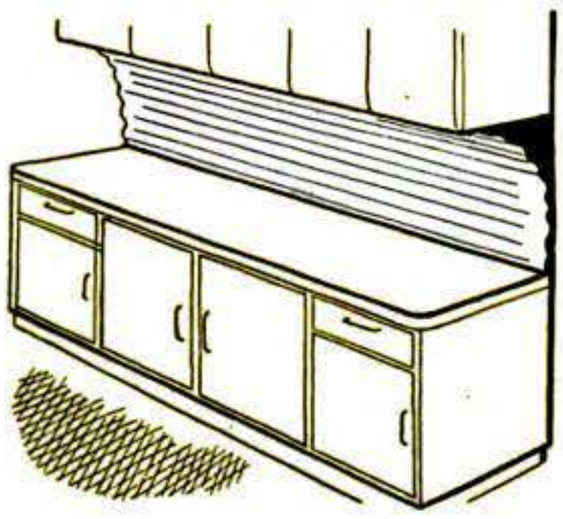
Three hinged pieces will stand alone as a screen.



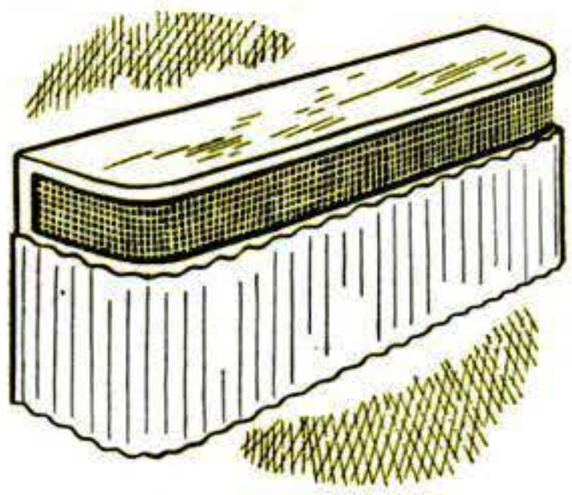
Old furniture is refaced with sections of a panel.



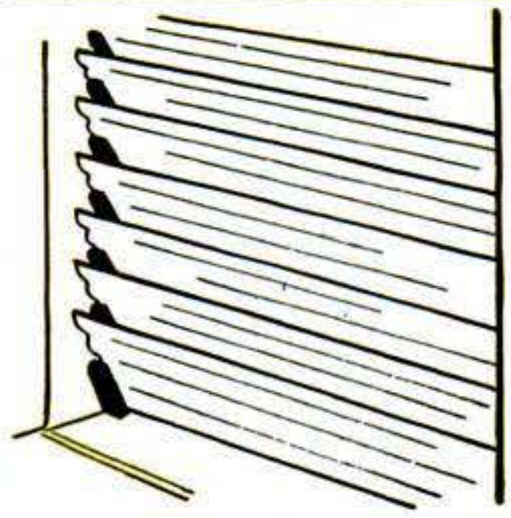
One panel is enough for several big light fixtures.



Fluorescent tubes behind panel light counter.



Prest-Glass forms handsome radiator enclosures.



Narrow strips make airy, bright louvered windows.

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Fireplace Set Made Without Forge

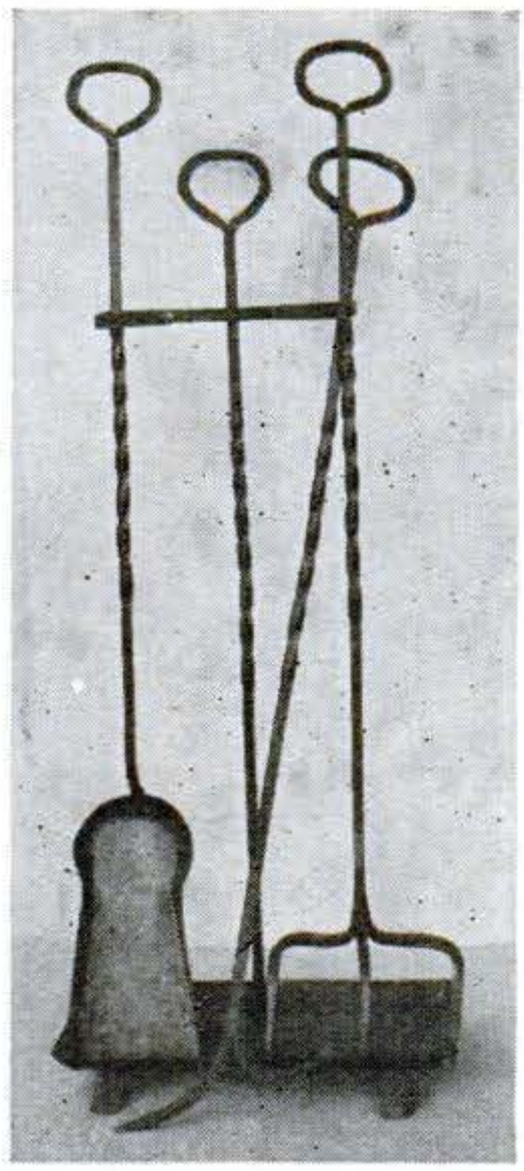
YOU needn't be a blacksmith, or have his equipment, to make this fireplace set. In place of a forge, you can use a gasoline blowtorch or coal fire to heat the pieces.

Hot-rolled mild steel ½″ or ⅝″ square is probably best for the job. Necessary tools include a sturdy vise, a ball-peen hammer, pliers, and small anvil or block of iron on which to shape the metal.

The hand grasp on each piece is made by heating the end of the rod bright cherry red and forming it into a loop.

Shear the scoop portion of the shovel from 16-gauge sheet iron. After heating, flatten and bend the end of the shaft to conform to the back of the shovel. Drill both of these parts and rivet them together.

The poker has a hook attached to the shaft. This may be either welded or riveted.

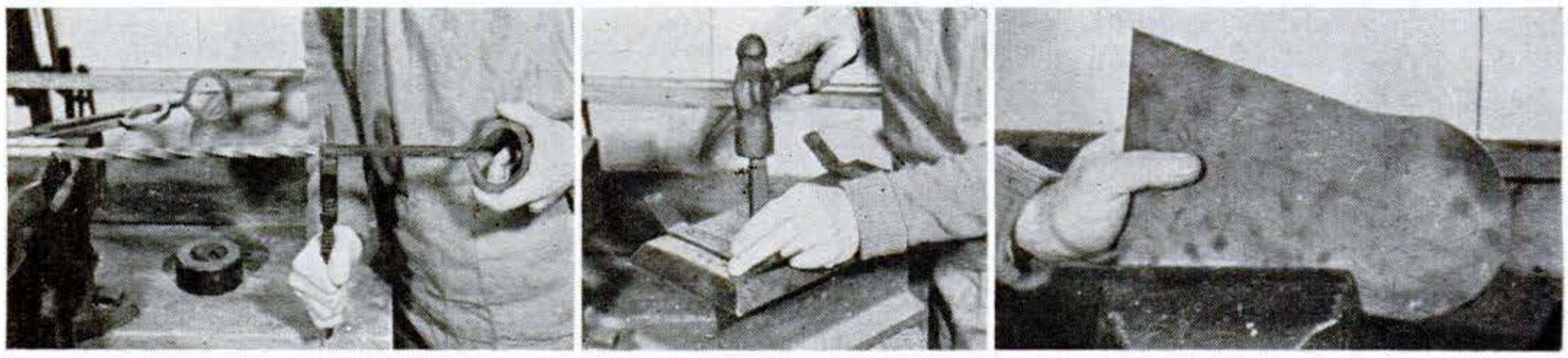


However, you might forget about the hook if the construction seems troublesome.

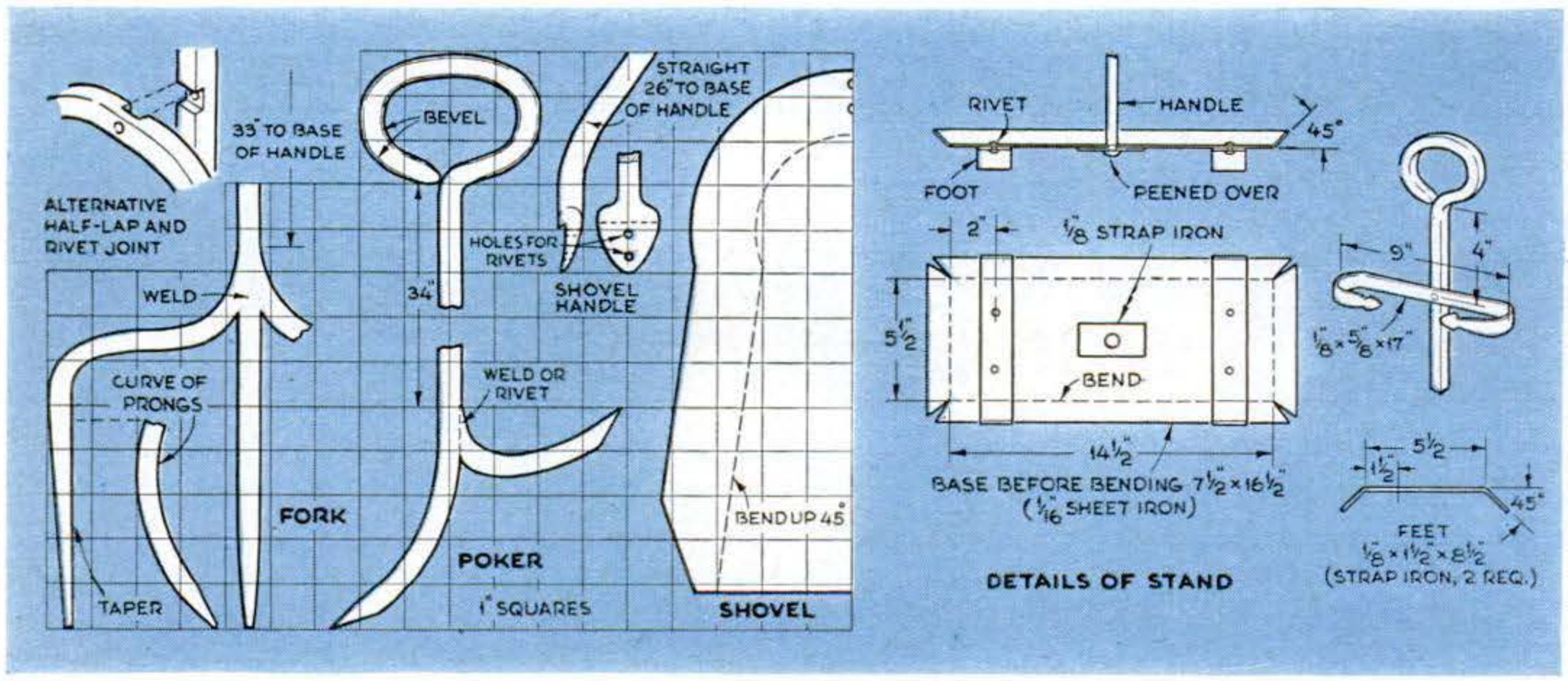
You can make the fork in one of two ways. In either case, the central prong is a continuation of the shaft. If there *is* a forge available, you can weld on the outer prongs. If not, better use a half lap and rivet joint. Cut the sides of the laps with a hacksaw, drill out the waste, and file the mating parts to a drive fit.

Use 1/16″ sheet metal for the stand. Cut the corners and bend up all sides to about 45 deg. The corners need not be fastened in any way. The legs are bent to shape without heating. Heat and hammer the bottom end of the shaft until it's round. Insert this through a hole drilled in the base and peen until it holds securely.

Give the finished set a coat of black stove polish.—*John P. Arnold, Doylestown, Pa.*



Decorative twists are formed in the shafts by clamping the cold metal in a vise and twisting with a long-handled wrench. Rivet strap-iron feet to the base of the stand, as seen in the center. Straight sides on the shovel are bent up 45 deg. in a vise while the metal is cold. Form the rounded part at back by bending over end of a pipe of suitable diameter.



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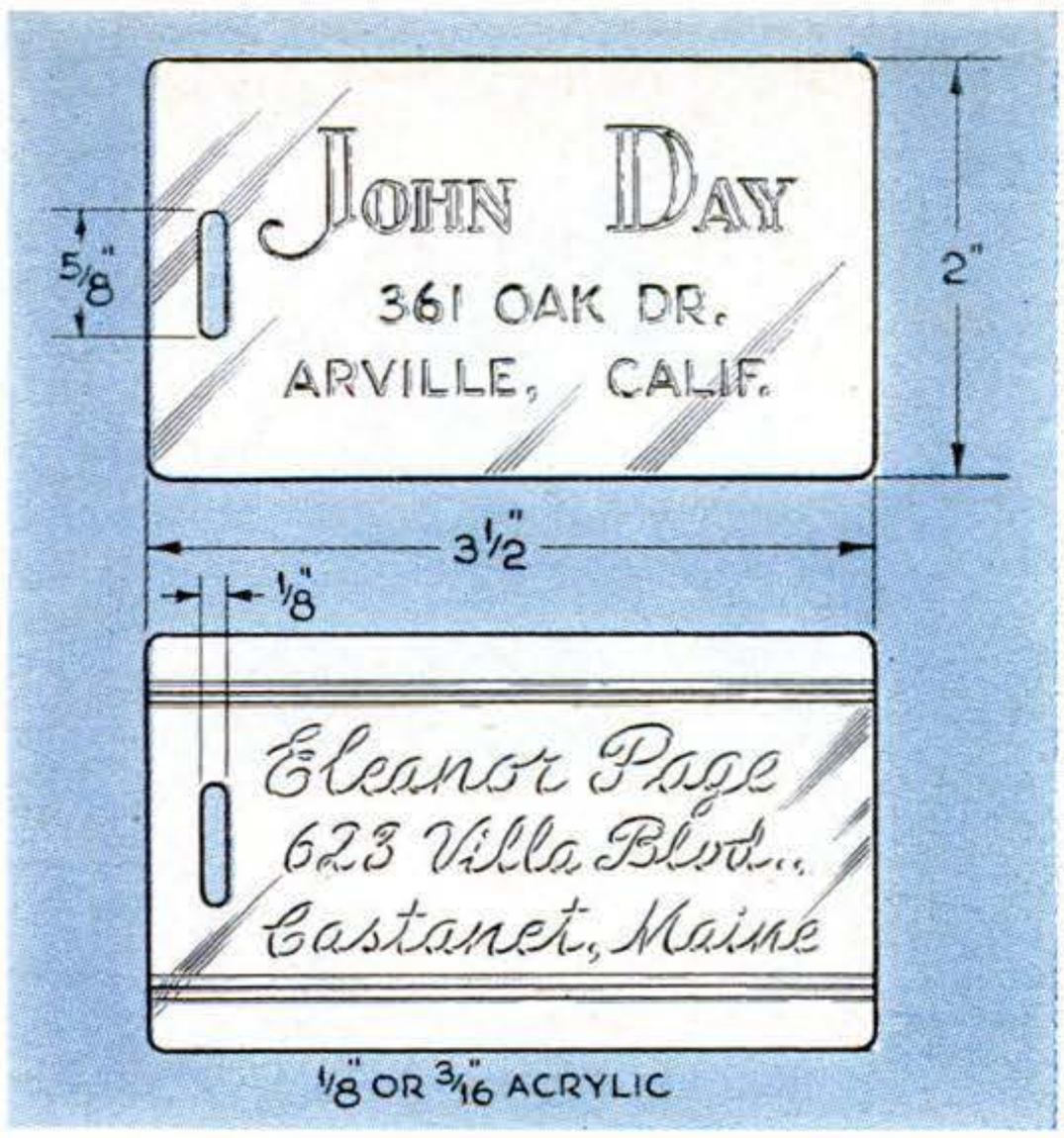
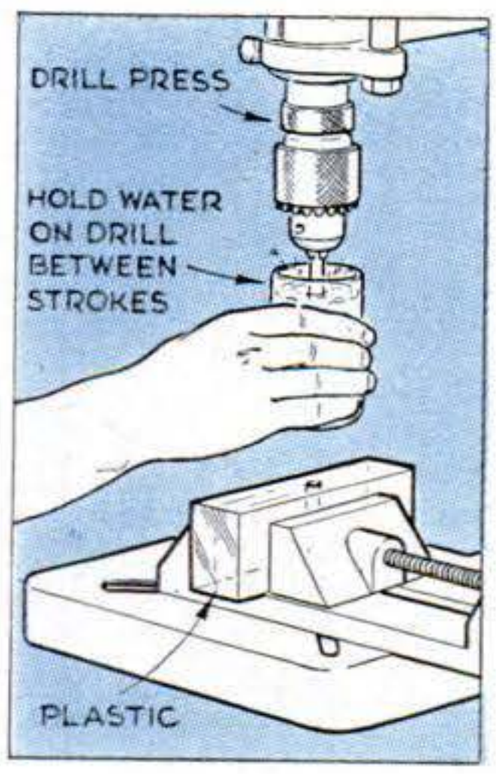


Luggage Tags Cut from Plastic

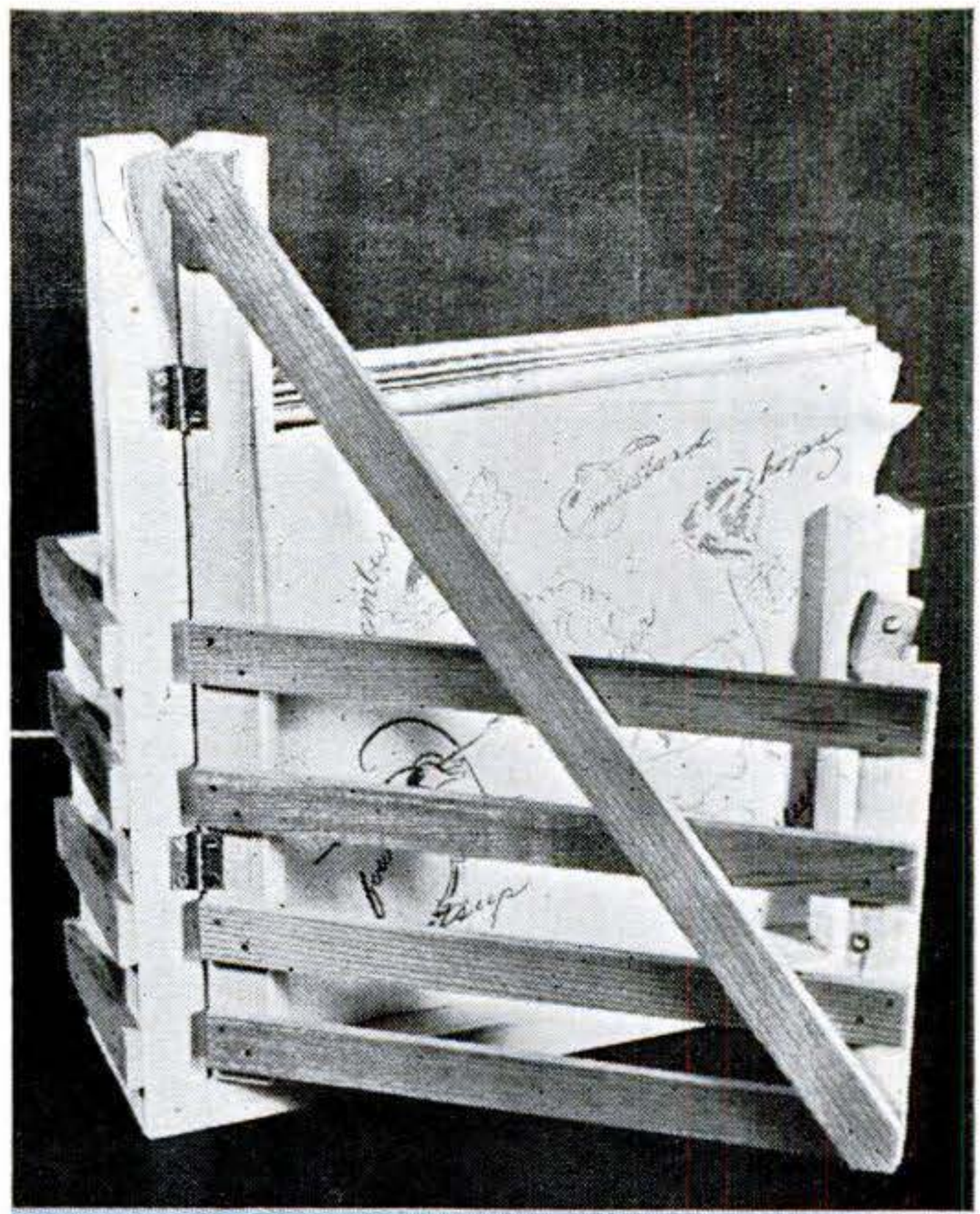
DURABLE and attractive identification tags may be cut from scraps of sheet plastic and engraved with your name and address. A good size is 3/16″ by 2″ by 3½″.

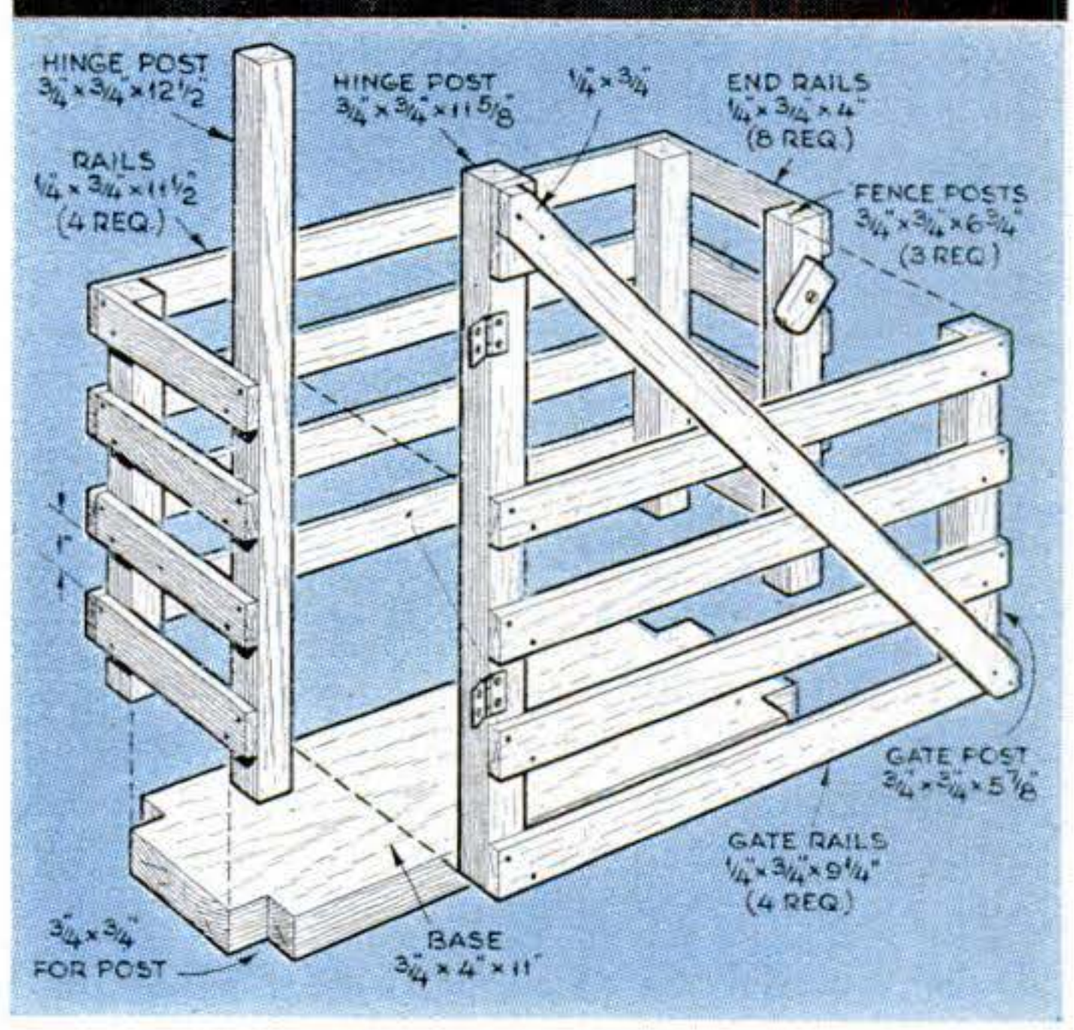
Cut a slot about ¼″ in from one end of the tag so you can attach it to the luggage. Letter the blank with a vibrator-type etching tool or a motor engraving tool. Scribing the letters with a sharp tool also produces a good job if done carefully. If you aren't skilled at freehand lettering, try engraving through a grease-pencilled layout on the plastic, or following a drawn layout seen through the piece.—*B. R. Evans, Los Angeles.*

Drill Water-Cooled for Plastic



WHEN drilling clear plastic, it isn't always easy to get a clean, smooth hole. A slow feed, frequent backing out to remove chips from the drill flutes, and a cool drill produce the best results. Keep a small jar of water handy and dunk the drill in it between each stroke. When you've finished, you'll have a clean hole. This method is not nearly as messy as lubricating the hole with oil as you cut it. Also, oil must be cleaned from the work when the job is done.—*Herbert Pfister, Bronx, N. Y.*





Midget Corral Holds Napkins

INFORMAL parties call for paper napkins, and this corral, a simple one-evening project, is just the place to keep them.

All the dimensions are on the drawing. The easiest way to make the ¼″ by ¾″ fence rails is to rip them from ¾″ pine stock on a circular saw. After cutting the pine base to size, notch the corners for the fence posts that are nailed in place. The rails are attached with brads.

Assemble the gate with brads and attach it to the post with ½″ butt hinges. A short piece of fence rail, screwed loosely to the post, will serve as a latch. After sanding the corral, finish with a coat of shellac.—*Whitney K. Towers, Los Angeles.*

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Extra Lamp Does Double Duty

Here's the long and short of it: One plug, one cord, and a pull-apart standard give you a table or floor lamp.

ALMOST every home can use an extra lamp—especially one that serves a double purpose. You can stand this one on the floor as a bridge lamp, or by removing the longer lower section of the standard and plugging the 10″ section into the base you can use it as a table lamp.

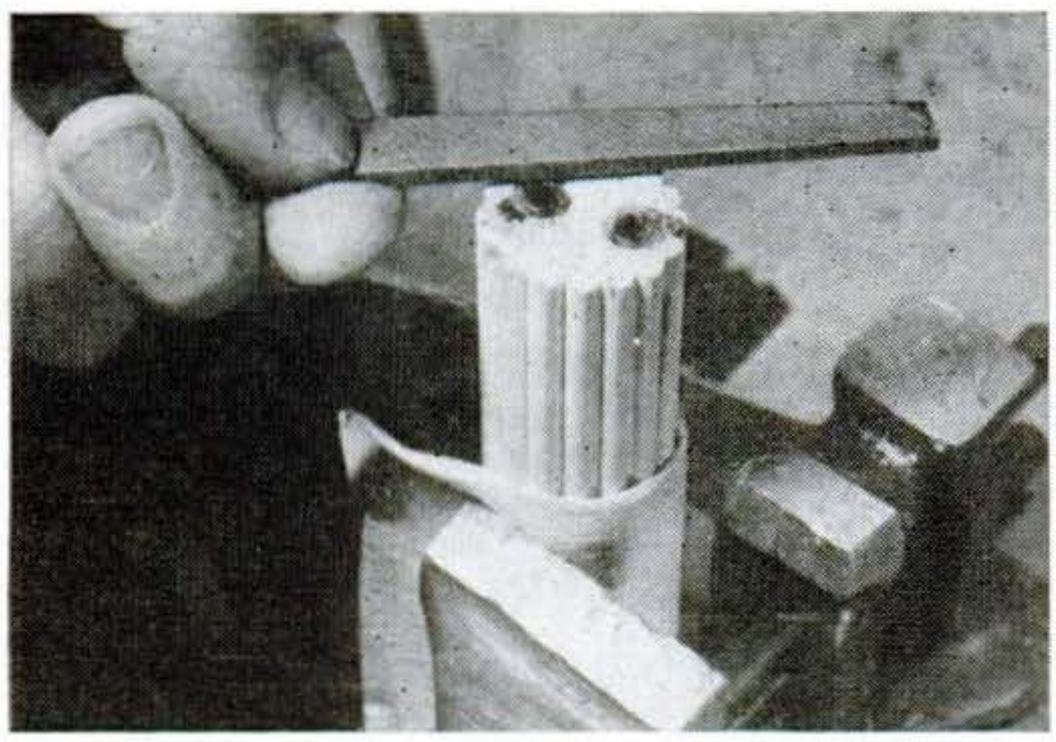
The parts are simple and inexpensive and only hand tools are needed. A fluted 1¼″ curtain pole 40″ long forms the standard. Two wooden dime-store plates, 8″ and 9½″ in diameter, make the base. The connectors are cut from a telescoping curtain rod.

Mark one groove of the fluted pole with a pencil line so you'll be able to match the sections after sawing. Cut the pole into a 10″ and a 30″ length. The shorter one is the standard for the table lamp. Before fastening the plates together with two machine screws, I screwed a large wooden electric-wire spool to the top plate. Besides improving the appearance, the spool provides a body for two connectors.

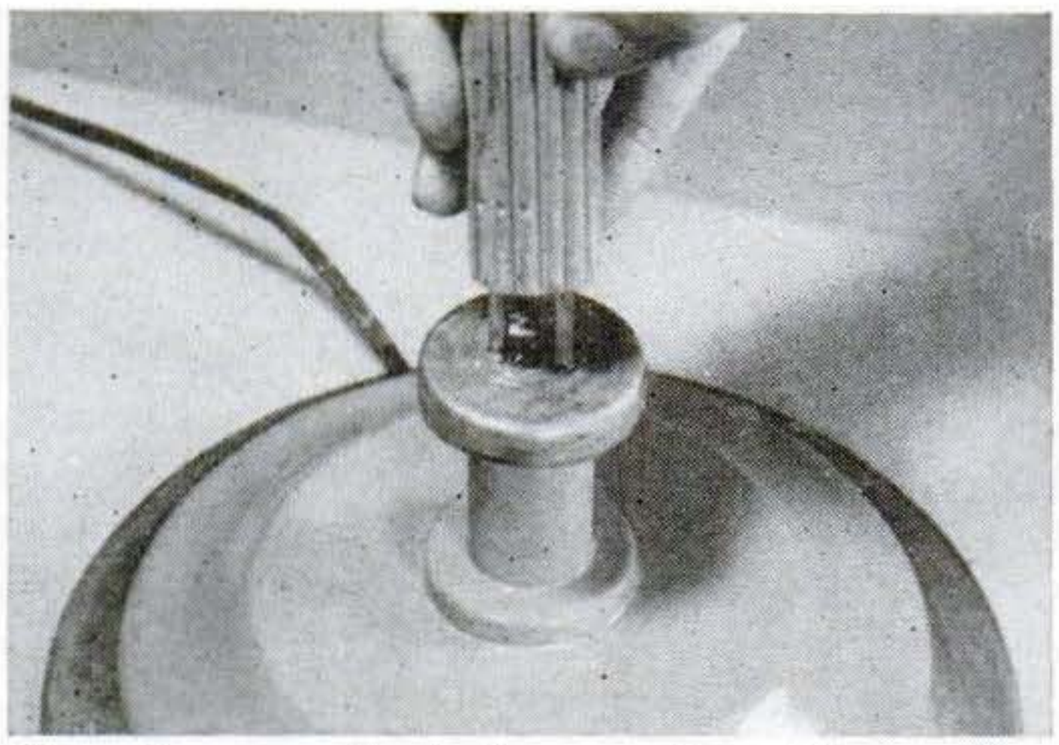
Leave the curtain rod telescoped when hacksawing the connectors, to prevent collapse of the tube sides. The male connectors are 3″ long. Half of their length is embedded in the two sections of curtain rod, as shown in the drawing on the opposite page. The female connectors in the top of the 30″ section of the standard are 1½″ long; the size of those in the spool will depend on the length of the spool.

After drilling holes for the connectors,

Here's the double-duty lamp in use as a floor lamp and, with a 30″ section removed, on a table. Paint it to match room where it's used.



After soldering, file off rough spots. Insides of contact sockets must be kept free of solder.



This shows method of connecting either section of the standard to the plug in base of lamp.

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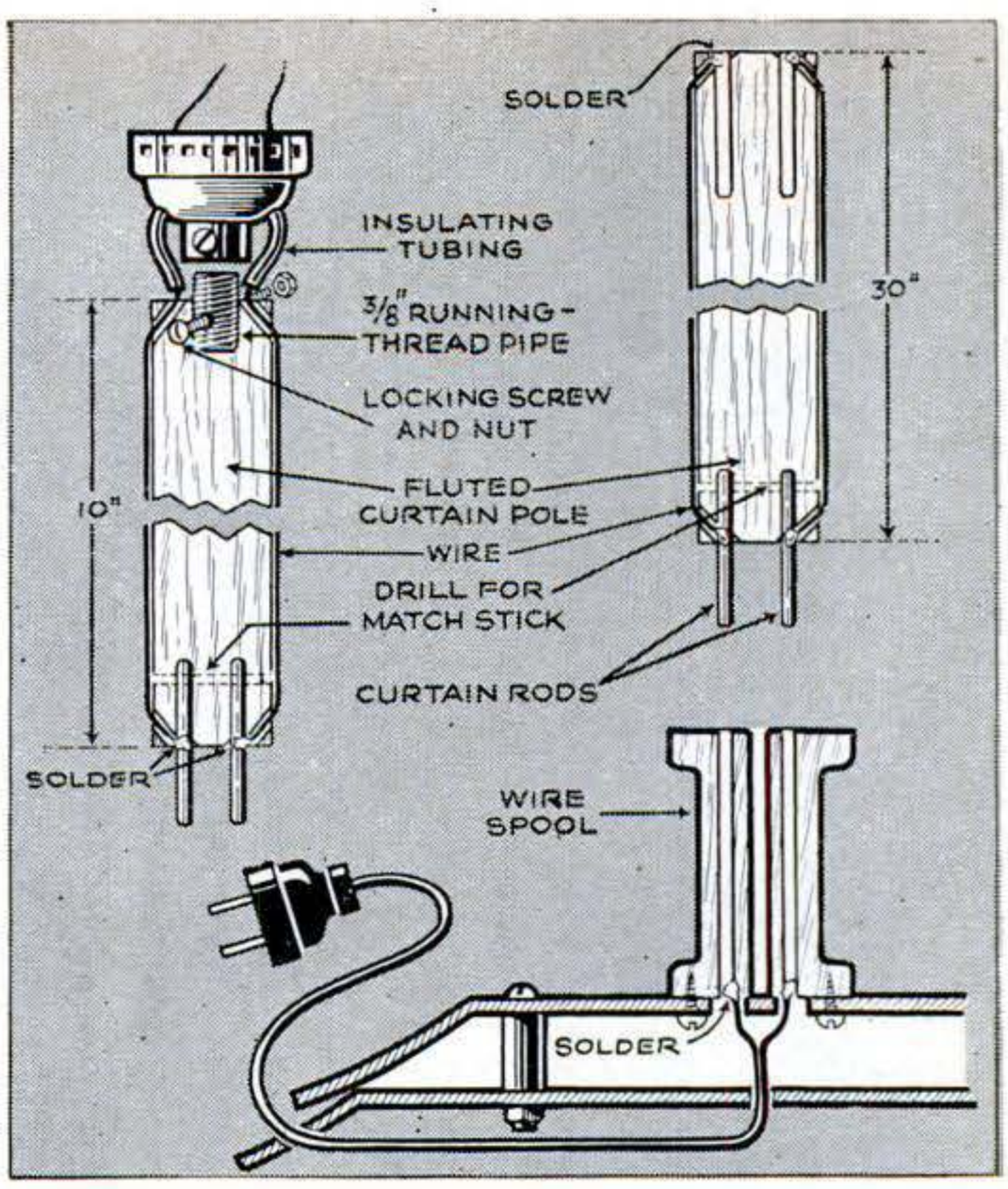
countersink the tops of the holes deeply. This recesses the "hot" parts and gives you room to solder. Then drill 1/16″ holes at angles to meet the tops of the connector holes. Solder No. 22 insulated wire (get plastic-covered if you can) to the prongs. Run it through the 1/16″ holes and up two flutes of the 30″ standard. Keep the wire taut along the sides of the pole and solder the ends to the female connectors.

Do the same with the bottom of the 10″ pole. In the top of this section, drill a ⅜″ hole for a short piece of ⅛″ pipe or a nipple (actually measuring ⅜″ o.d.). If you can't get a side-outlet socket cap, drill two ⅛″ holes in the lower part of the cap as indicated. Radio spaghetti tubing protects the wire here.

To prevent the prongs from pulling out of the pole, drill a ⅛″ hole through the pole and prongs. Then dip a match stick in glue and shove it through the hole. Snip off any protruding sections when the glue has dried.



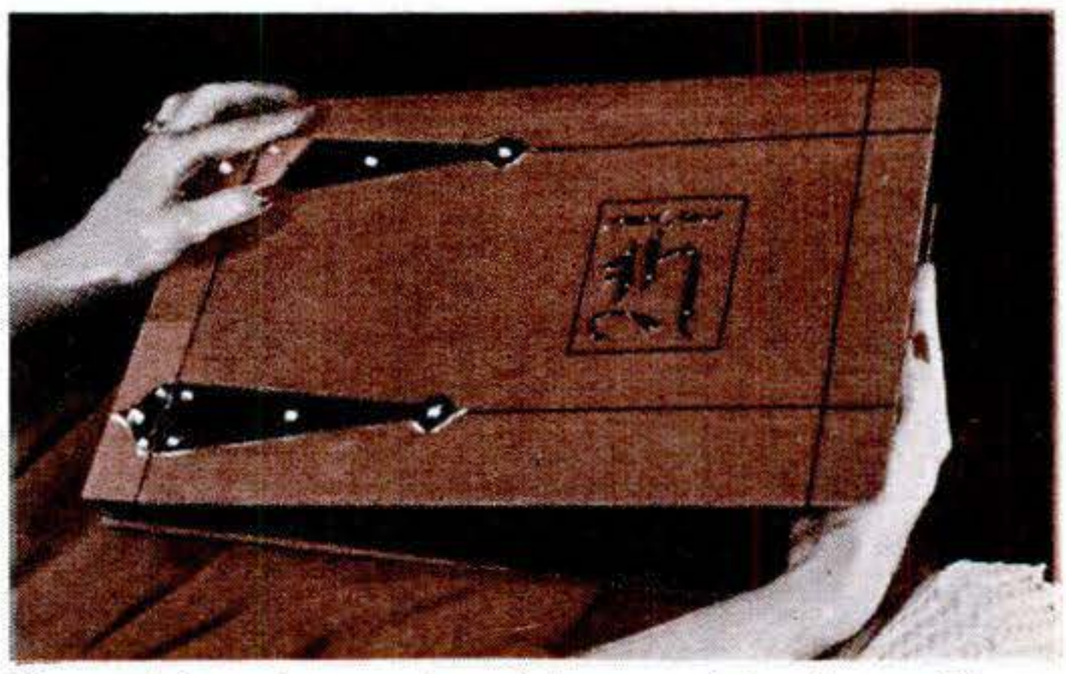
Here are details of double-purpose lamp. Solder cord in base before joining the plates.

Plywood and Gleaming Brass Bind Album

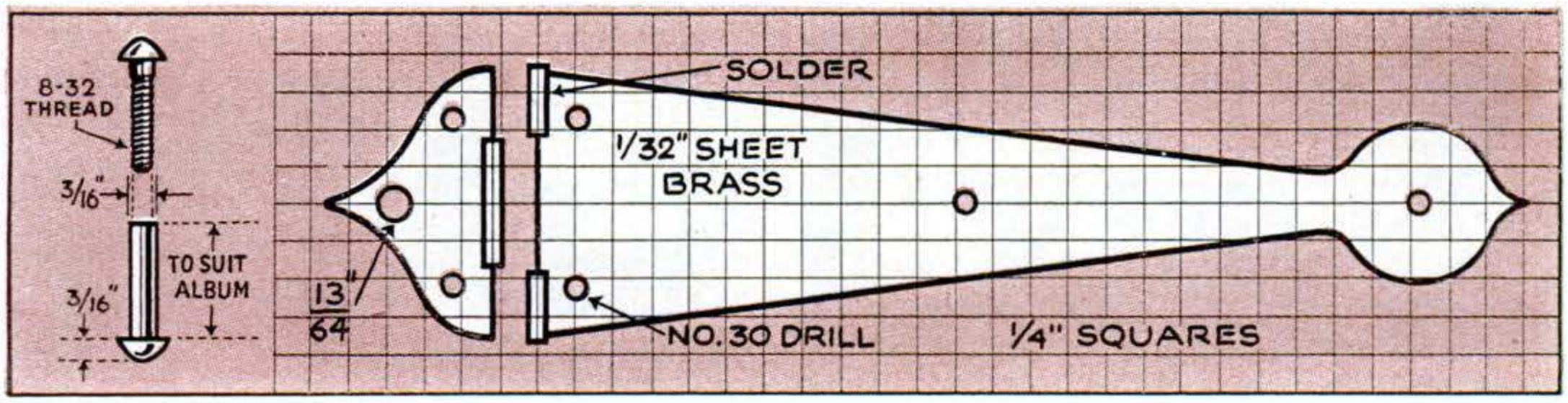
THE covers of a paper-bound album, especially one that sees a lot of use, tend to become ragged. A permanent binding of plywood covers with brass hinges will get away from the tattered appearance and also give your album a handsome finish.

I used ⅛″ mahogany plywood. Cut it to the dimensions of the old covers. Sand the pieces, spray them with clear lacquer, sand lightly, and spray again. Cut the ornamental hinges from 1/32″ sheet brass to the dimensions shown at the bottom of this page, or make them to your own design. The parts that take the hinge pin—a section of 3/32″ brazing rod—were rolled around the pin.

Fasten the hinges to the cover with brass rivets. These and the stud and nut that bind the album were turned on a lathe. However, they may be bought. As a finishing touch, I cut my initial out of sheet brass and used smaller rivets to hold it to the cover. Old English is a nice type face for this. The final step is applying clear lacquer to the hinges and initial to prevent tarnishing.—*John J. Harper, Atlanta, Ga.*



Bound in plywood and brass, this photo album is now an attractive addition to the living room.



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Radio-Phono Combination Doubles as Bedside Table

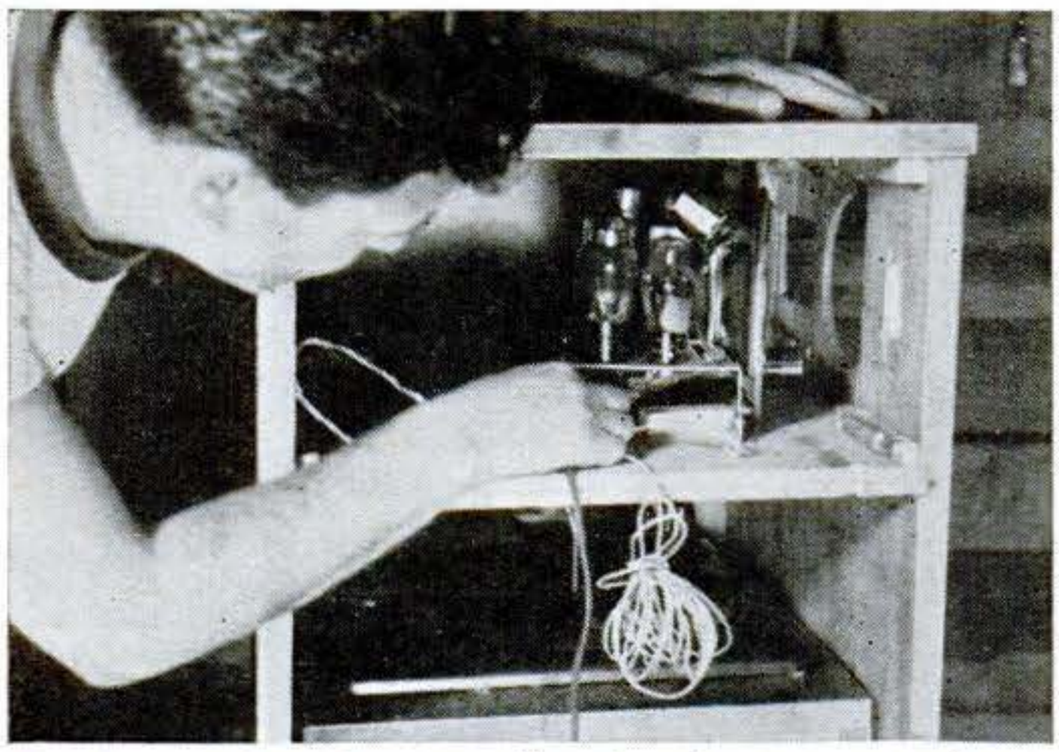
Finished cabinet has veneer strips on all exposed edges. Radio panel is piece of plastic.

YOU can use this radio-phono combination beside a bed, where it'll double as a night table, or you can place it in the living room beside an easy chair. Radio, changer, and record storage are compactly arranged.

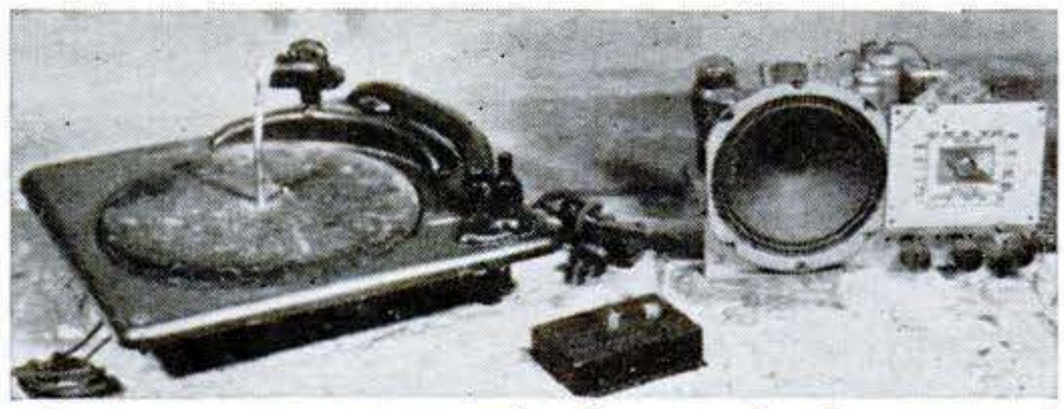
No dimensions are given here since the size of the cabinet is controlled by the size of the radio and changer. I built the cabinet of ¾″ mahogany-veneer plywood except for the two shelves. Because these do not show, ¾″ fir plywood was used.

First step is to measure the radio and changer. Then you can determine the cabinet dimensions. Leave an extra space over the radio for ventilation. When you lay out the side panels, allow for the thickness of the two shelves—for the radio and for the record-changer drawer. The album storage space, too, should be high enough to permit easy removal of a 12″ album.

The side panel that will house the controls must be routed out to ¼″ over an area the size of the radio's front. This will permit the control shafts to reach through the plywood. To slide the changer drawer, you can use channel iron and small ball-bearing wheels, or a pair of the commercial slides made for this purpose. Finish the cabinet with a mahogany oil stain and clear lacquer.
—Walter Fischman, Philadelphia, Pa.



Radio is fitted into side of cabinet routed out for it. Wooden blocks hold the radio in position.



Here are the works. The box in the foreground contains the radio-phono connection and switch.

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What's Your Ingenuity Quotient?

I had to yank the engine out of a car and I had no hoist or other lifting device. However, a dump truck was handy. I lashed a piece of channel iron to the body of the truck with about 3′ of it sticking out over the rear. Then the truck body was raised to dumping position, bringing the end of the iron down over the engine. One end of a chain slung around the engine was hooked over the channel iron. I hopped in the truck, slowly lowered the body, and the engine was out.—*F. J. Malloy, Windsor Locks, Conn.*

A good bang with a sledge fixed up my well that had been refusing to give water. When it went dry, I felt certain there was plenty of water underground but the screen at the bottom of the casing was clogged. After removing the pump, I filled the pipe almost to the top with water from a nearby creek. Then I cut a long wooden plug that fitted snugly into the top of the 40′ casing. When I hit the plug, the water in the pipe was forced down, clearing the screen.—*George Woods, Waimate, N. Z.*

After laying a 1″ conduit in concrete, we found we couldn't get the cable through because of two 45-deg. fittings. We hooked a vacuum cleaner hose over the conduit in the cellar and fed a round cork with a thread attached into the other end. The vacuum sucked the cork through. A heavy cord was pulled through next and then the cable.—*H. Durwood Butts, Brownville, N. Y.*

Though my car has no T-zone, it served very nicely to break in my new pipe. When the garage returned the car after an overhaul, the mechanic said to let the engine run at least three hours. I intermittently connected the pipestem to the wiper hose and smoked several pipes of tobacco, giving the new briar a good "cake." —*Marvin S. Carty, Mt. Holly, N. J.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

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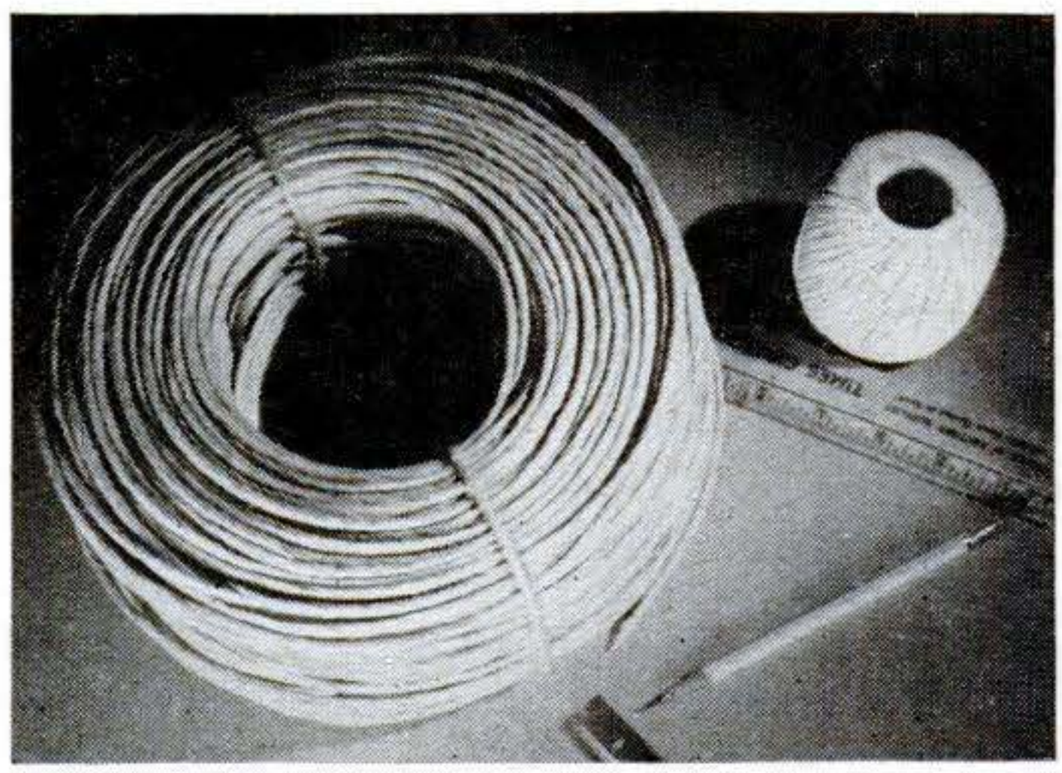
Four V-sections are a sign of the true rush seat. There's nothing more appropriate for early American ladder-backs.

Rush

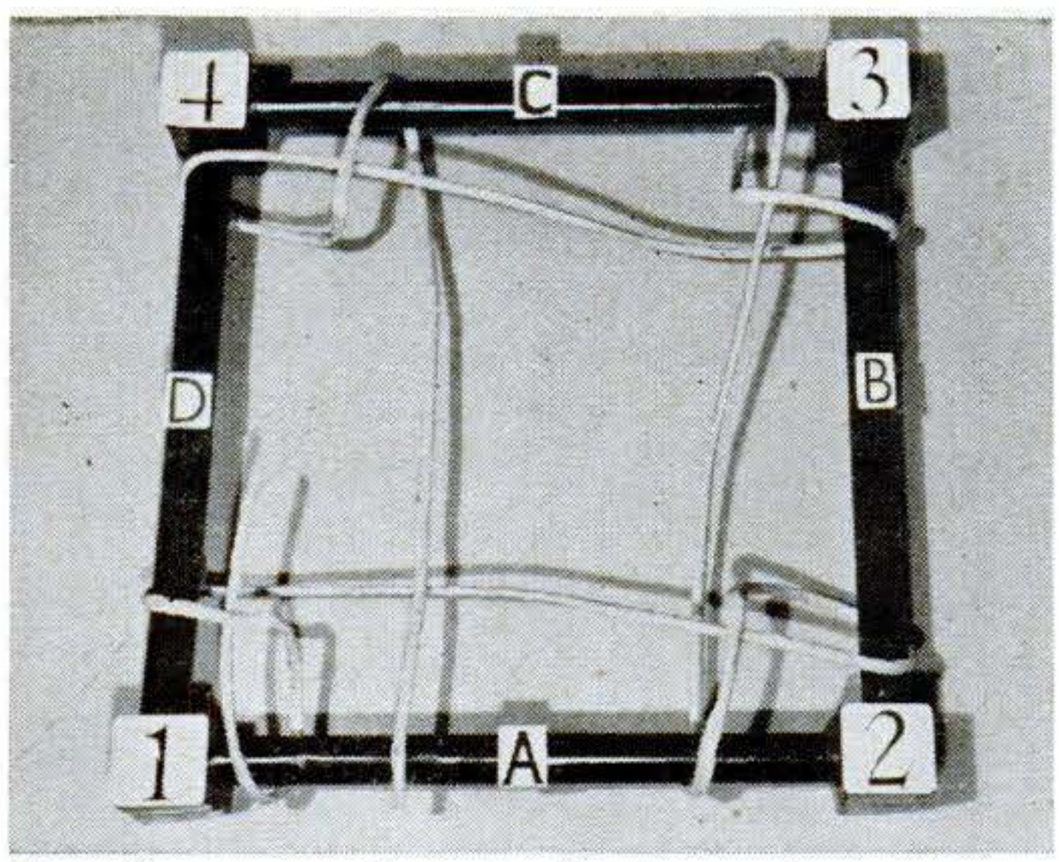
By R. P. Stevenson

LIKE most crafts, weaving rush seats takes a certain amount of skill. But that's no reason to avoid the job. Your first attempts may not entirely equal those of the old hand, but you're sure to find your own entirely satisfactory. The job is simple enough.

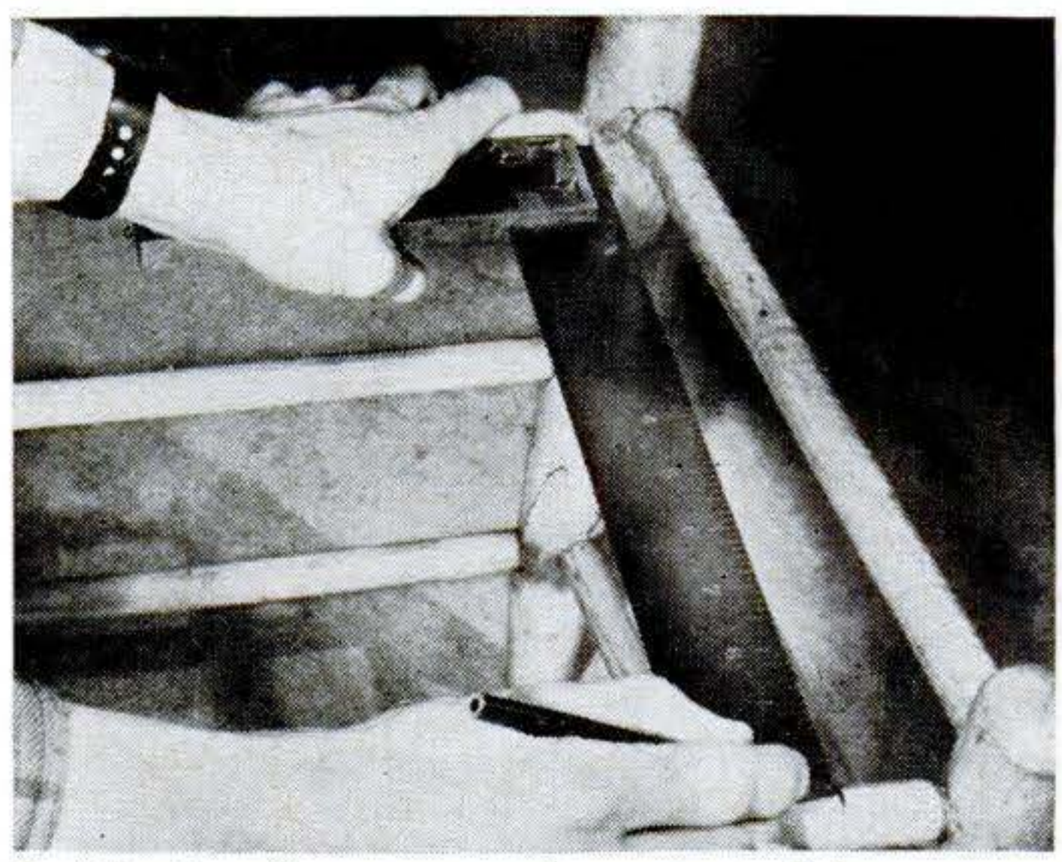
Natural rush is seldom used today. A manufactured material called fiber cord provides an excellent substitute. Made of tightly wound paper, it is inexpensive and closely resembles natural rush. Available from various paper and handicraft supply houses, fiber cord is made in three diameters—⅛", 5/32", and 3/16". It's packaged in rolls.



1. Fiber cord is now used in place of natural rush. Besides a roll of this, you'll need only the simple equipment that's shown above.



Simple weave does it. Begin at 1, pass over and under A, over short end, around D, across to B, repeat there, and continue around frame.



2. Mark off a centered section of front rung equal to length of rear one, with ruler or square. This is needed because seat is not square.

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for Your Seats

Costing around a dollar, a 2½-lb. roll has enough material to complete a chair of ordinary size—with enough left over for a good start on a second. For the average small chair, it's probably best to choose either ⅛″ or 5/32″ cord.

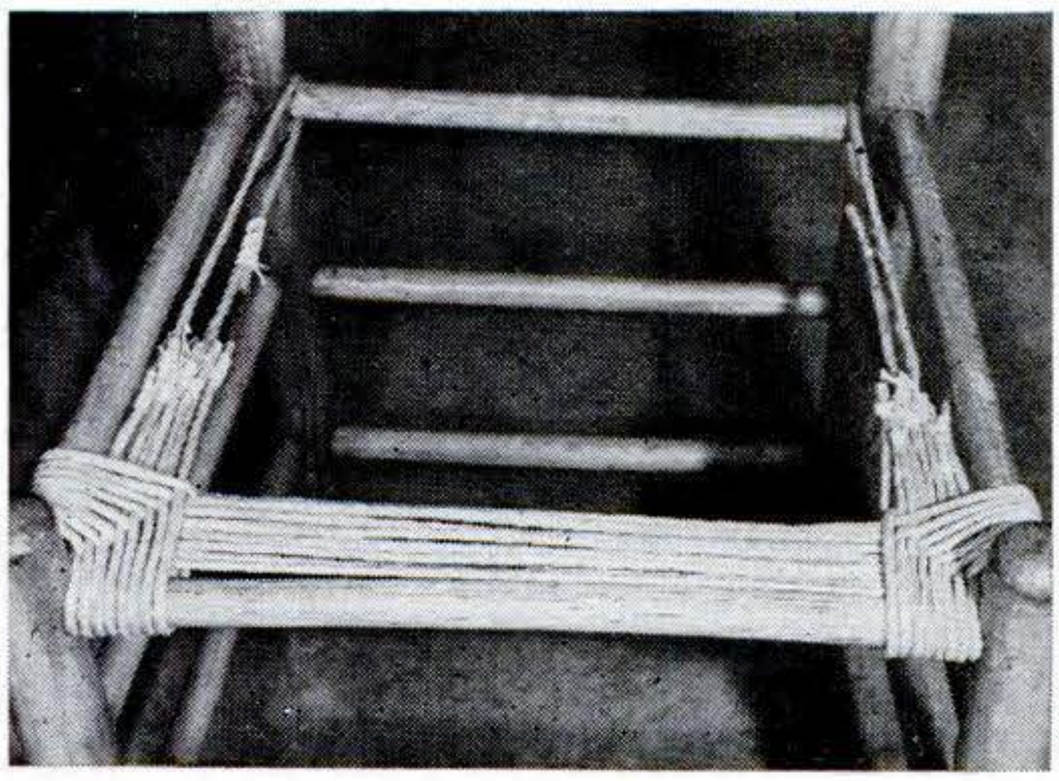
You might practice first on a stool. Here the area to be woven is either square or rectangular. You should start—and complete—the job exactly as illustrated on the demonstration frame in an accompanying photo.

Beginning at corner 1, pass the cord over and under A, over the short end, over and under D, across to B, repeat the same thing at this corner, then on to 3, then to 4, and finally back to the starting point. Continue around and around in the same way until the seat area is filled.

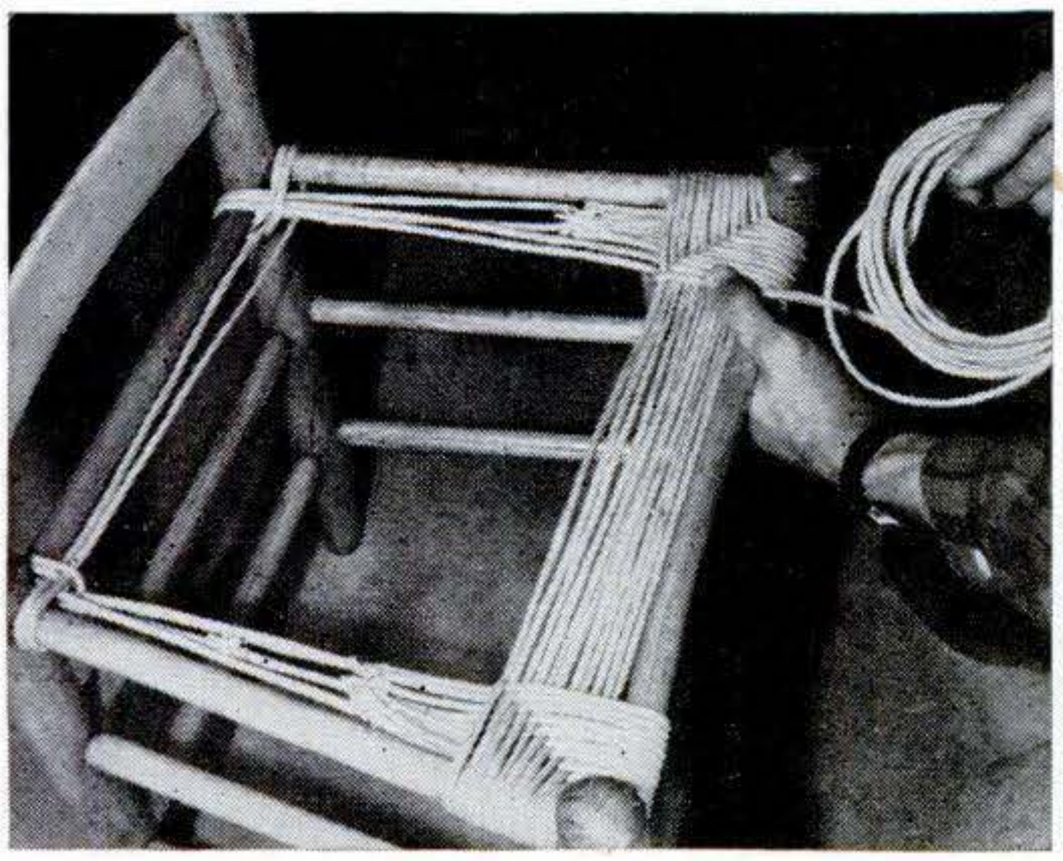
For demonstration only, the cord was left loose at each corner in this example. In practice, it should be pulled snugly against each corner post—and each successive strand aligned closely against the preceding one. Here, the weaving is done counterclockwise, but it can be done the opposite way.

In a chair, you must take into account that the seat area is generally wider in front than at the back. Because of this, you would wind up with a similar irregular opening at the center that you couldn't fill—if you proceeded as with a stool.

On the front rung, mark off a distance



3. Weave short pieces until open part of front rung equals back one. Tie to the loop at left, weave around corners, and tie to other loop.



4. Now weave around and around. Keep tension of cord even. Dip each new length of cord in water for a few seconds before using it.

5. Stuff seat underneath with pieces of kraft paper as the strands begin to close. Jam it in with ruler or wood cut to triangular section.

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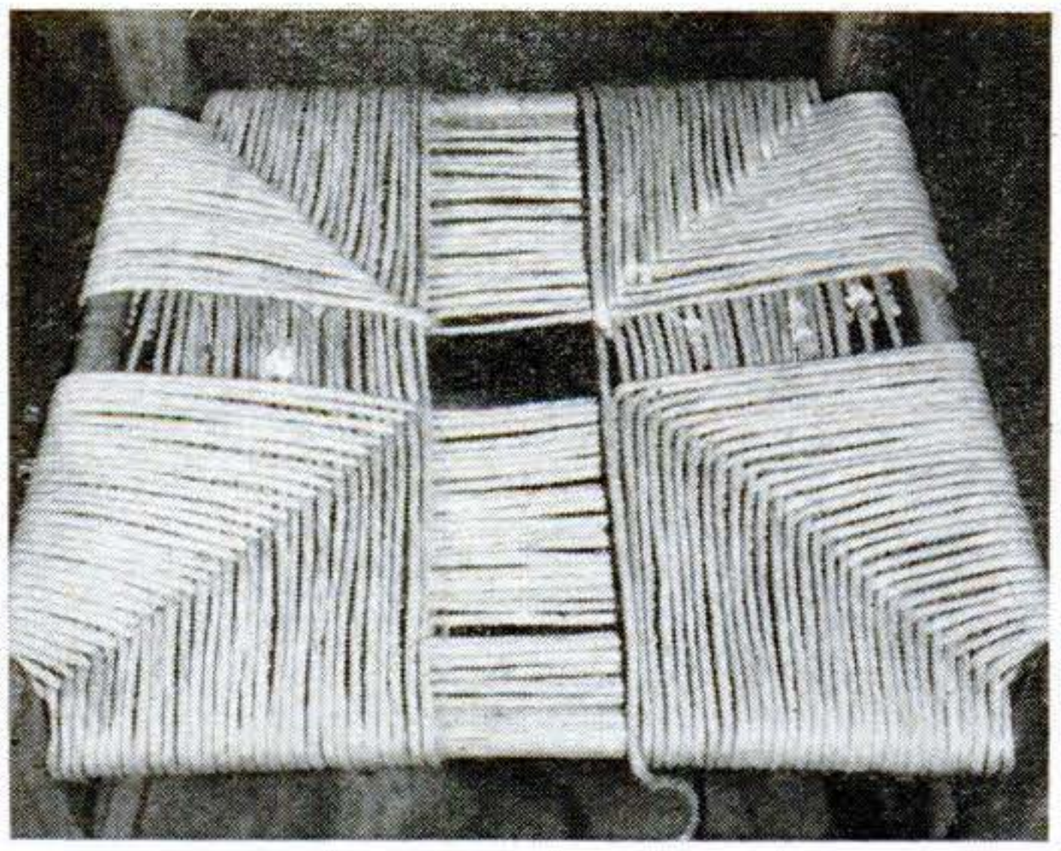
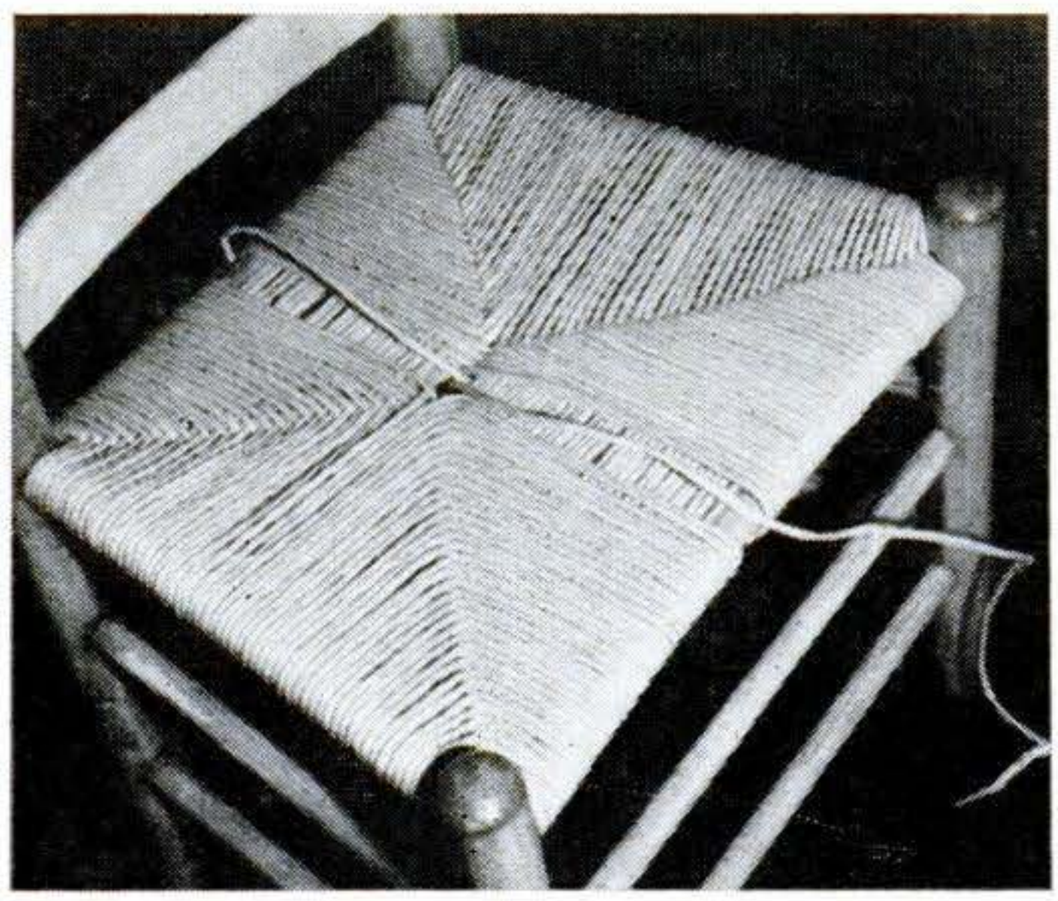
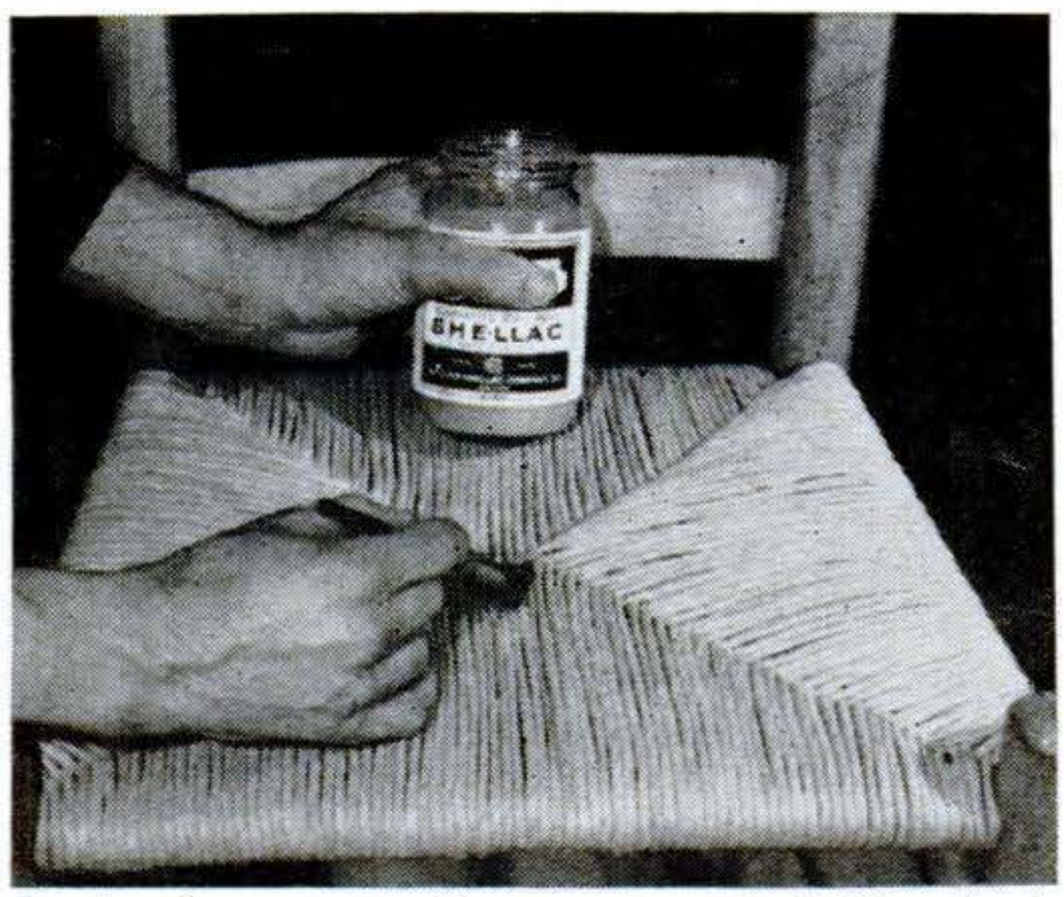


6. Keep the strands parallel and square as you progress toward the center. Work with about 15′ lengths, coiled up or rolled on a stick. Tie each new length to the end of the old one.



7. In most chairs, the weaving will close up at the sides first. After this happens, weave back and forth between front and back until the center is filled. Tie the end underneath.



8. Apply two or three coats of shellac, both top and bottom, and the job is done. It may not entirely equal professional work, but it will give you satisfaction—and cost less.

equal to the length of the rear one, placing each pencil line the same distance from a front corner post. You must now weave out to these lines at each front corner before weaving continuously around the chair. Short pieces are used here.

Sometimes the ends of the short pieces are tacked under the side rungs (D and B in the demonstration frame). In this case, however, it was found easier to loop a length of fiber cord around the rear rung (C), tie the ends of the loops securely together with string, and then likewise tie the weaving pieces to these loops.

When this short-piece weaving has been carried out on the front rung to the pencil marks, you have squared up the seat area and weaving can continue around and around in the same manner as for a stool.

Dip each length of your rush into a pan of water for a few seconds before applying it. This will enable you to tie the ends more securely with string—as well as form the cord snugly around the rungs. When tying a new piece to the preceding one, be sure the joint will fall under the seat.

As you weave, pull each strand snug—but don't exert any particular amount of force. Strength is not required for the job. Even tension is the thing. At each inside corner, bend the fiber at a 90-deg. angle with your fingers instead of trying to pull it into that position. Keep the strands parallel, and be careful that the one you are applying doesn't ride up on the preceding strand, especially under the seat.

In the old days, the craftsman usually stuffed the seat with some of his natural rush to give it body. Today, kraft shopping bags torn into small pieces offer good material for this. Fine excelsior also may be used.

When only about an inch of weaving space remains on the side rungs, turn the chair upside down and stuff the filling into the triangular openings. Some also may be placed in the top spaces—but be careful not to use so much that the seat is caused to bulge.

The seat area in most chairs is broader than it is deep. Hence, the strands will close up first at the sides—just as they would in the case of a rectangular stool. When the sides are filled, weave back and forth between the front and back, bringing each strand up through the center slit. When this area is filled, tie the end of the cord to the back rung underneath.

Protect the finished seat with two or three coats of clear shellac. END

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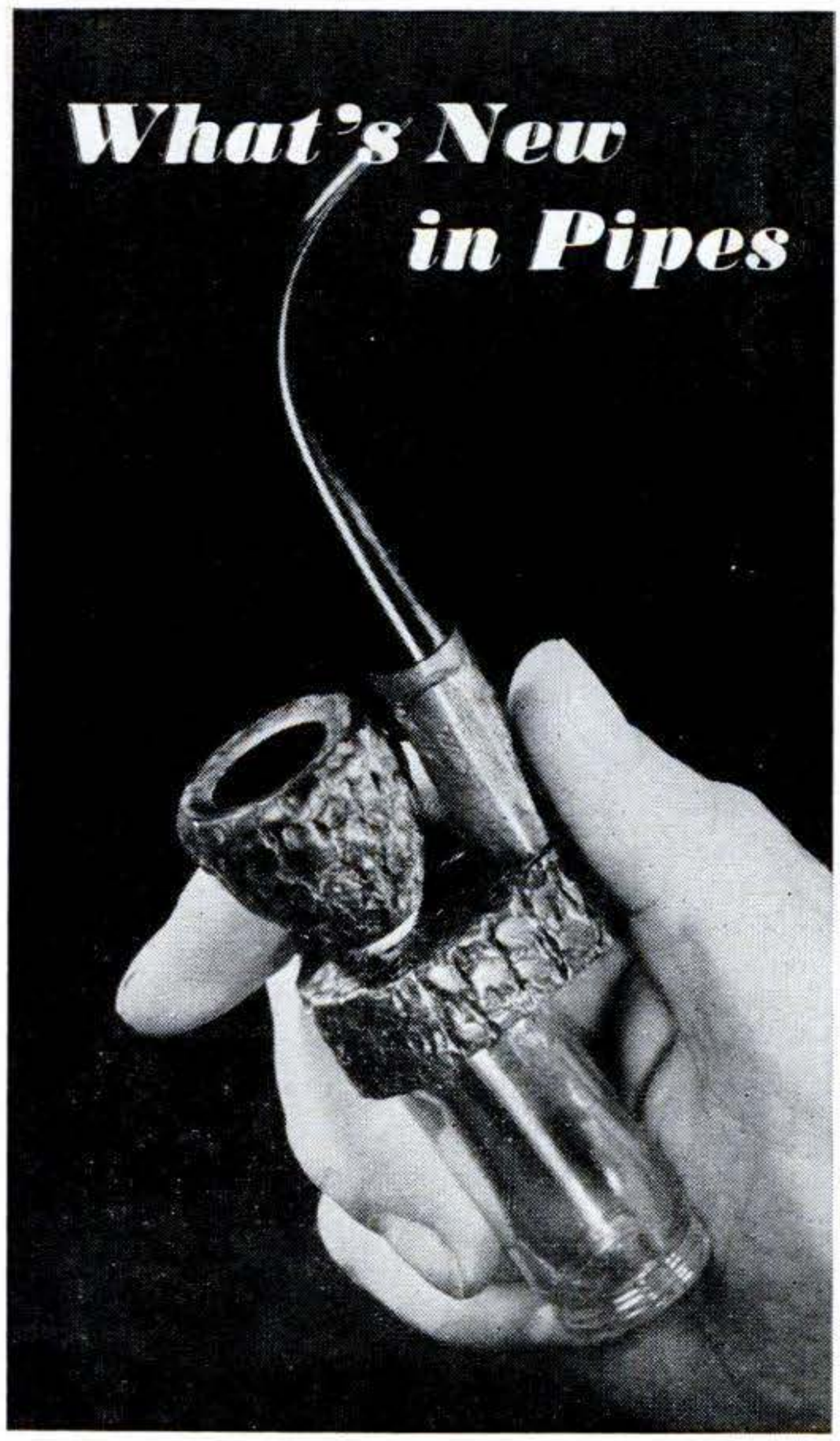
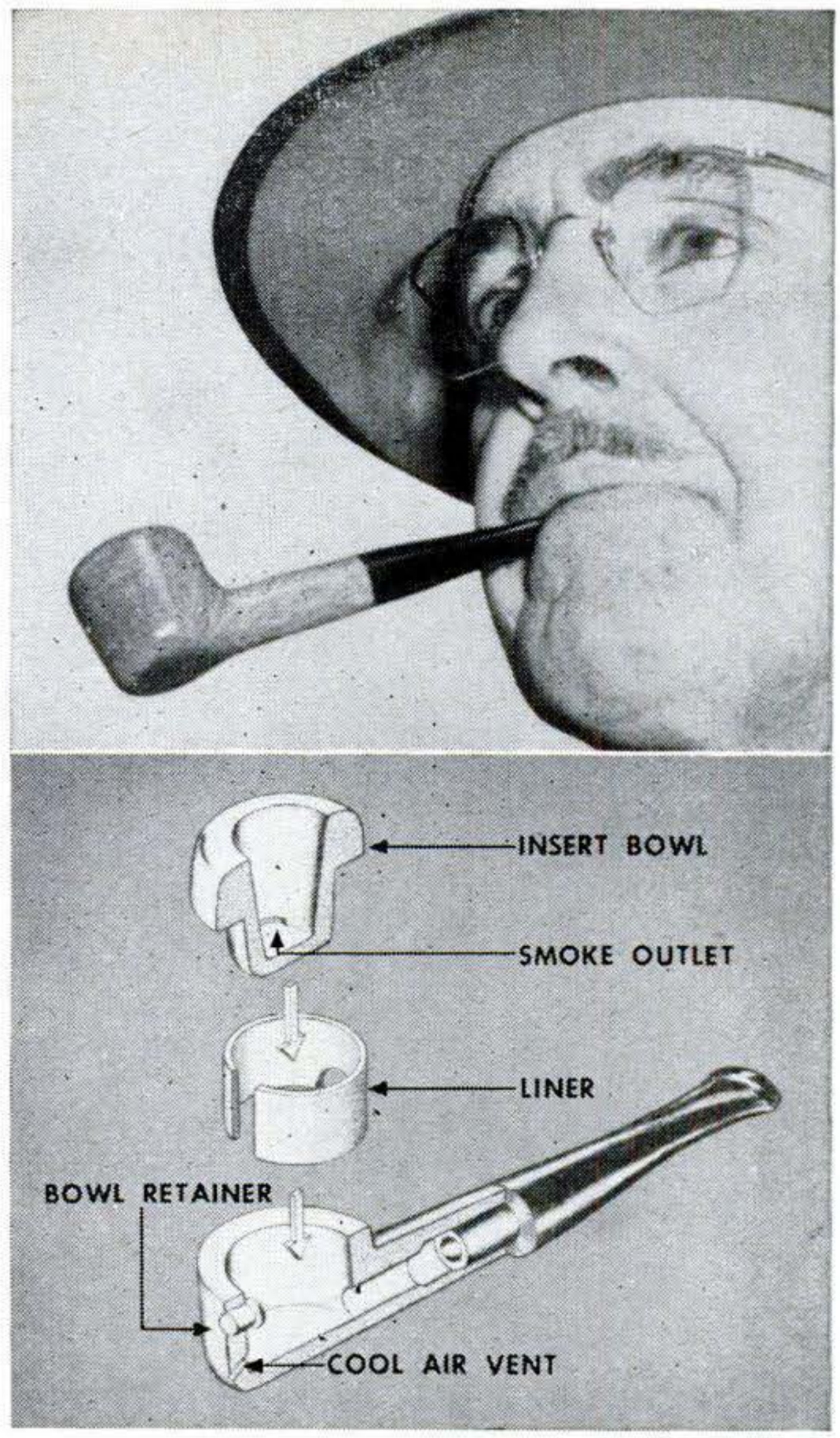
What's New in Pipes



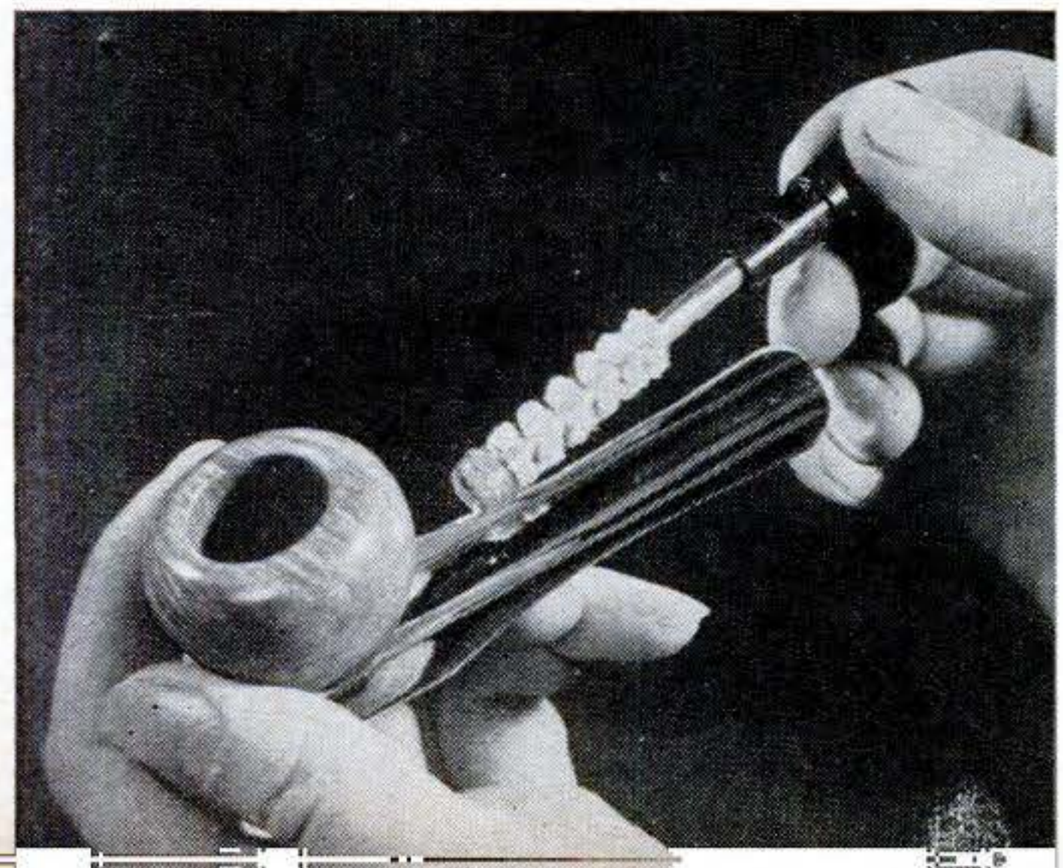


Liquid Filters Smoke. While water usually is used in the glass filter jar beneath the bowl of this pipe, the maker, Century Briar Pipe Co., Brooklyn, N. Y., suggests wine or cordial as an occasional substitute. Smoke is drawn from the bowl, through the liquid, and then into the stem. In a rough finish, the price is $2.50; smooth, $3.50.

Pipe Has Cooling Chamber. Smoke drawn through the slotted outlets expands and cools as it enters the air-cooled chamber formed between the bottom of the bowl and the pipe body. The liner absorbs moisture. Made of imported briar root and in several finishes, the Pavey Pipe Co., of Seattle, Wash., prices them at about $12.50.

Plunger Cleans Stem. A composition piston on the end of the plunger scrapes all tars and juices from the metal stem of this pipe as the bit is withdrawn. The maker, Spiral-Kool Pipe Co., Santa Monica, Calif., offers three models in an aluminum alloy at $2, $3.50, and $7.50.

Tamper-Spade Fits on Pipe. About the length of a kitchen match, this gadget snaps into a holder screwed to the shank. One end is round and flat for tamping tobacco in the bowl. The other is spade-shaped for loosening ash or dottle. James King & Co., Portland, Ore., sells it for $1.



1. To remove the metal connector from a hard-rubber stem, lay the stem on a vise and crack it. Then clean out the threads.

2. If the tenon of an old stem is broken off in a pipe, start a wood screw in the hole and pull out the broken piece with pliers.

Carving Plastic Pipestems

By W. Harrison Packer

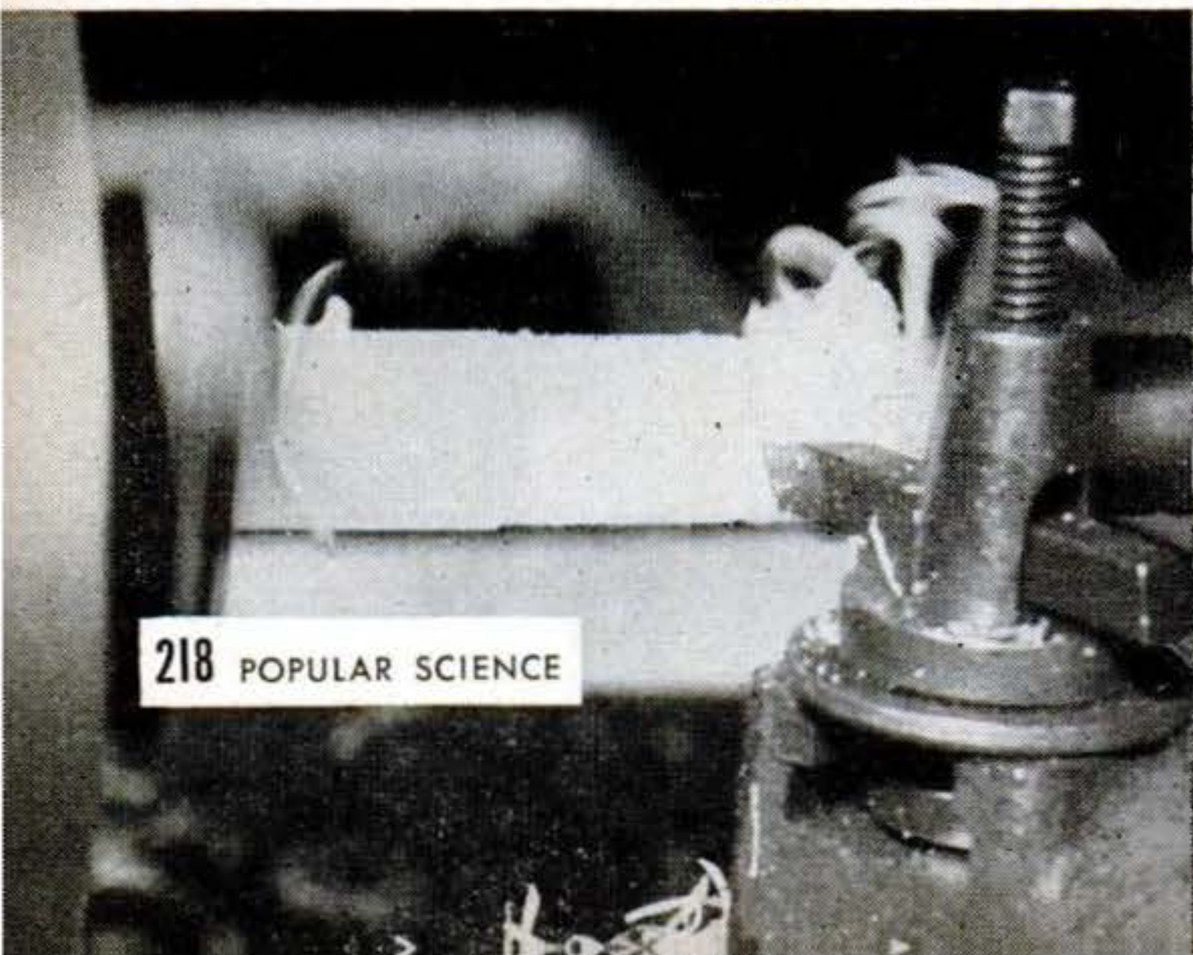
YOU CAN put this in your pipe and smoke it: besides being better looking than the usual hard-rubber stems, plastic stems are a lot tougher. If you're a man who bears down heavily, you probably gnaw through a factory-made job in a few weeks. On the other hand, a plastic stem will give you months of good smoking.

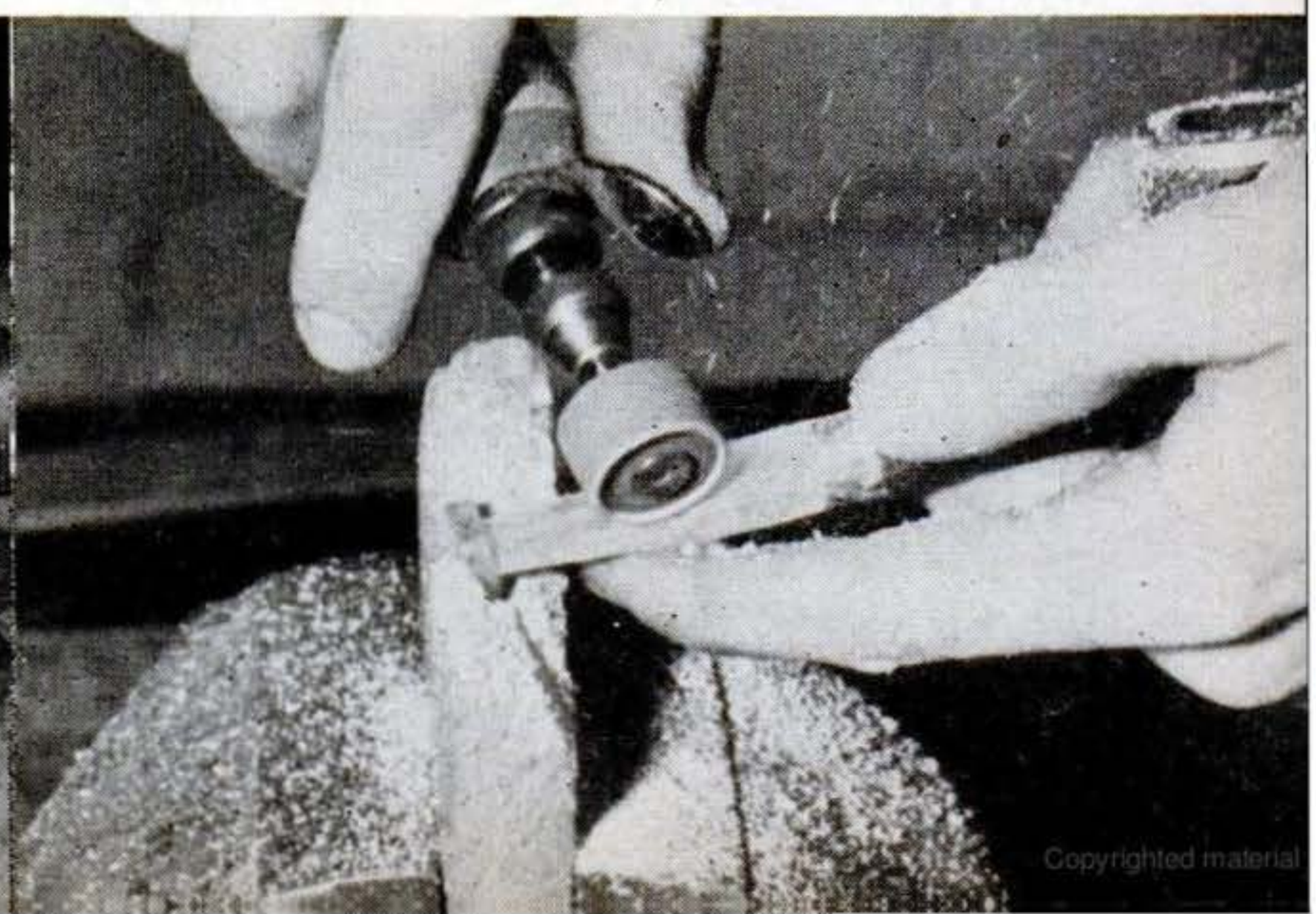
Use cast (not extruded) plastic, either clear or opaque ¾″ or 1″ bars. Cut them about ⅛″ longer and wider than the finished stem will be. Don't forget to include the length of the tenon that fits into the shank.

Drill a 3/32″ hole lengthwise through the rod. A smaller one will not admit a pipe cleaner and a larger hole means a thick stem, objectionable to some smokers. While drilling, lubricate with a light oil or water. If an oil film remains in the hole, remove it with a pipe cleaner dipped in alcohol.

5. Turn down the rod on a lathe. For a pipe with a metal connector, face off square the end that is to be drilled and tapped.

6. Shape the lip of the stem with the edge of a flat file. Then use a hand grinder with ¾″ abrasive drum to cut away excess material.





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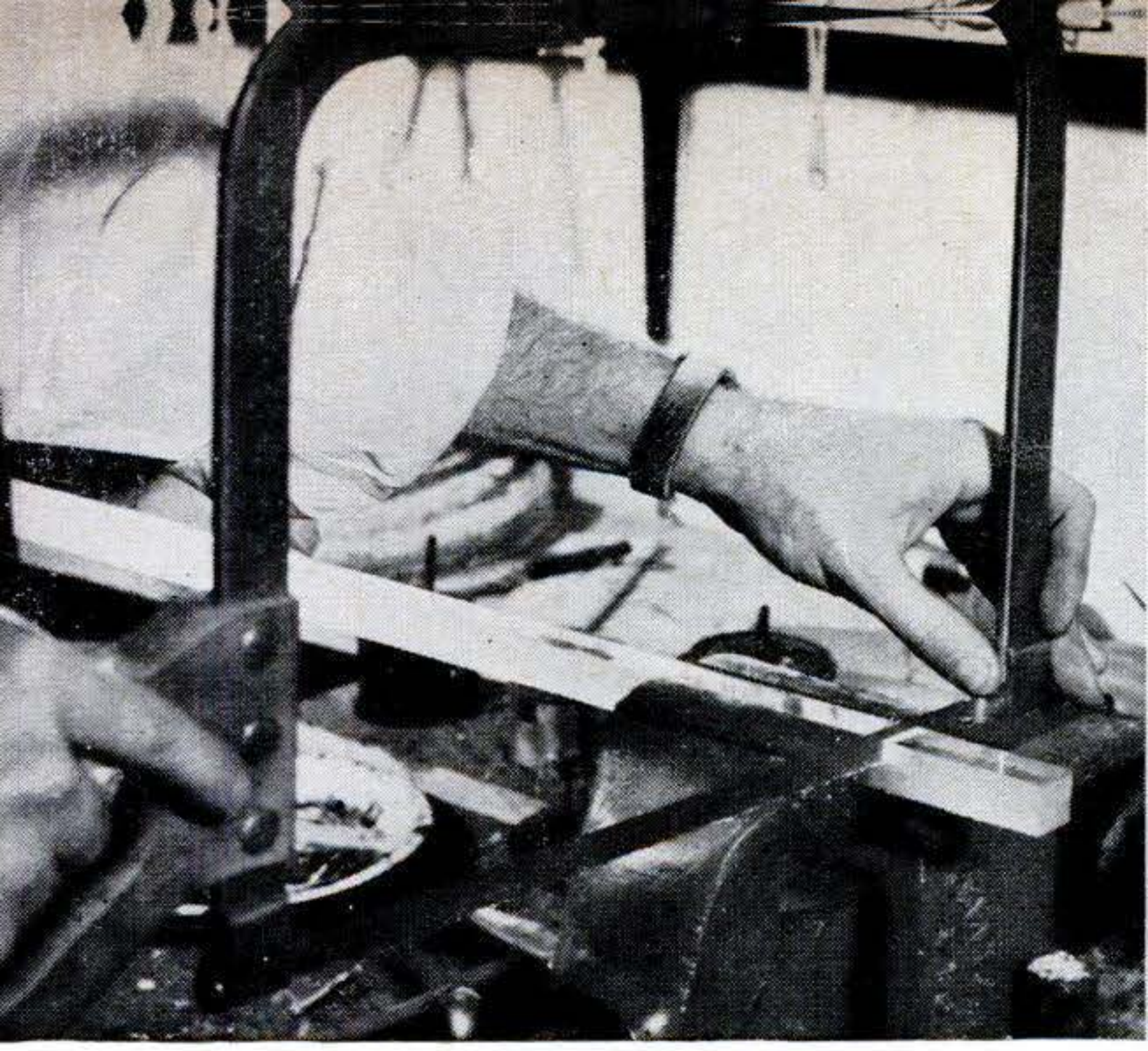
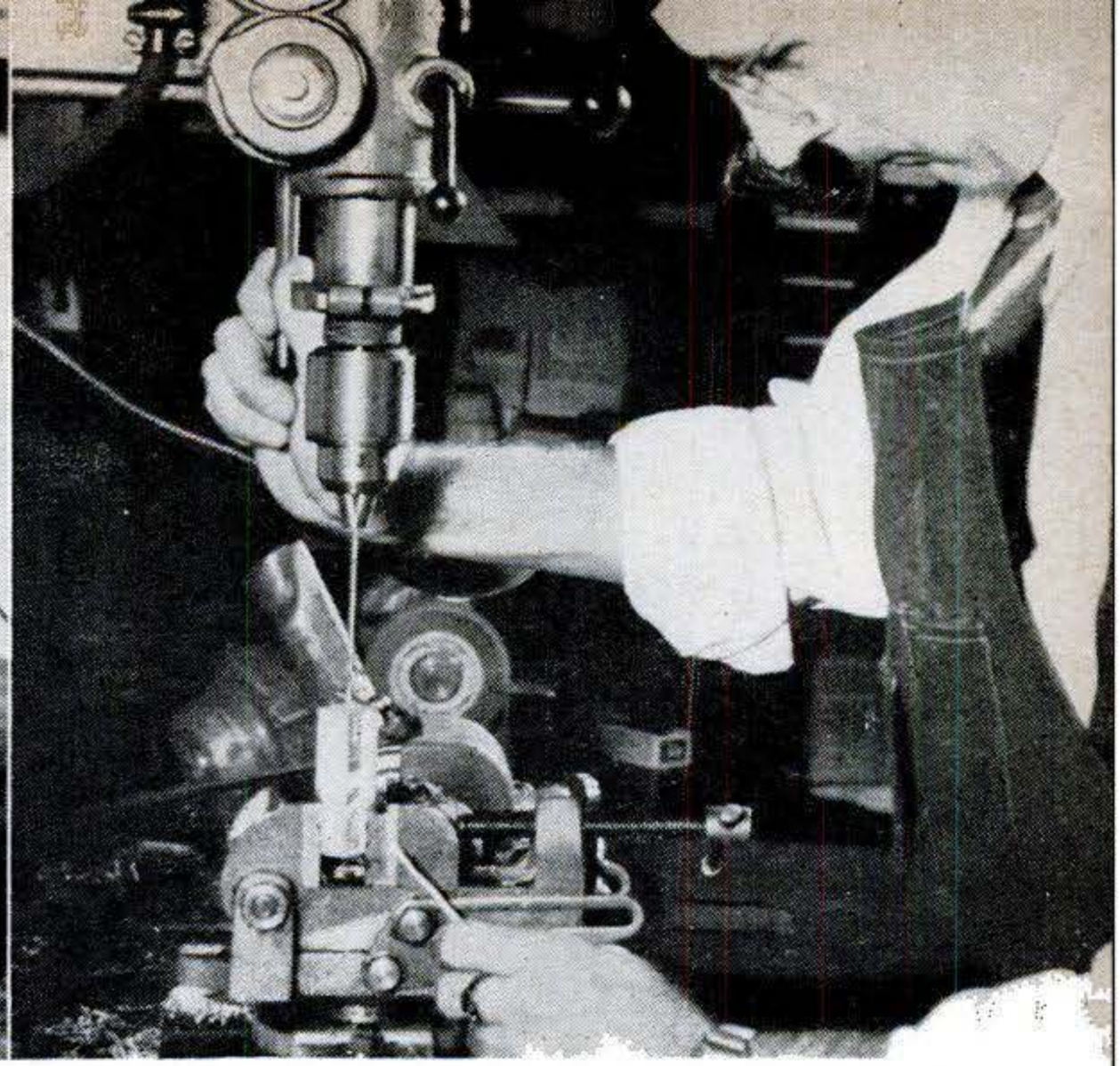


3. Plastic bars ¾″ or 1″ square serve as blanks for homemade pipe stems. Cut them ⅛″ wider and longer than the finished stem.



4. Drill a 3/32″ hole lengthwise through the rod. Lubricate with a light oil or water and frequently withdraw the drill to clear out chips.

Then turn the rod to the diameter of the widest part of the old stem. Do not turn it down to the diameter of the shank of the pipe, since the hole is not exactly centered in many pipes. In this case, the excess material remaining on one side must be removed with hand tools.

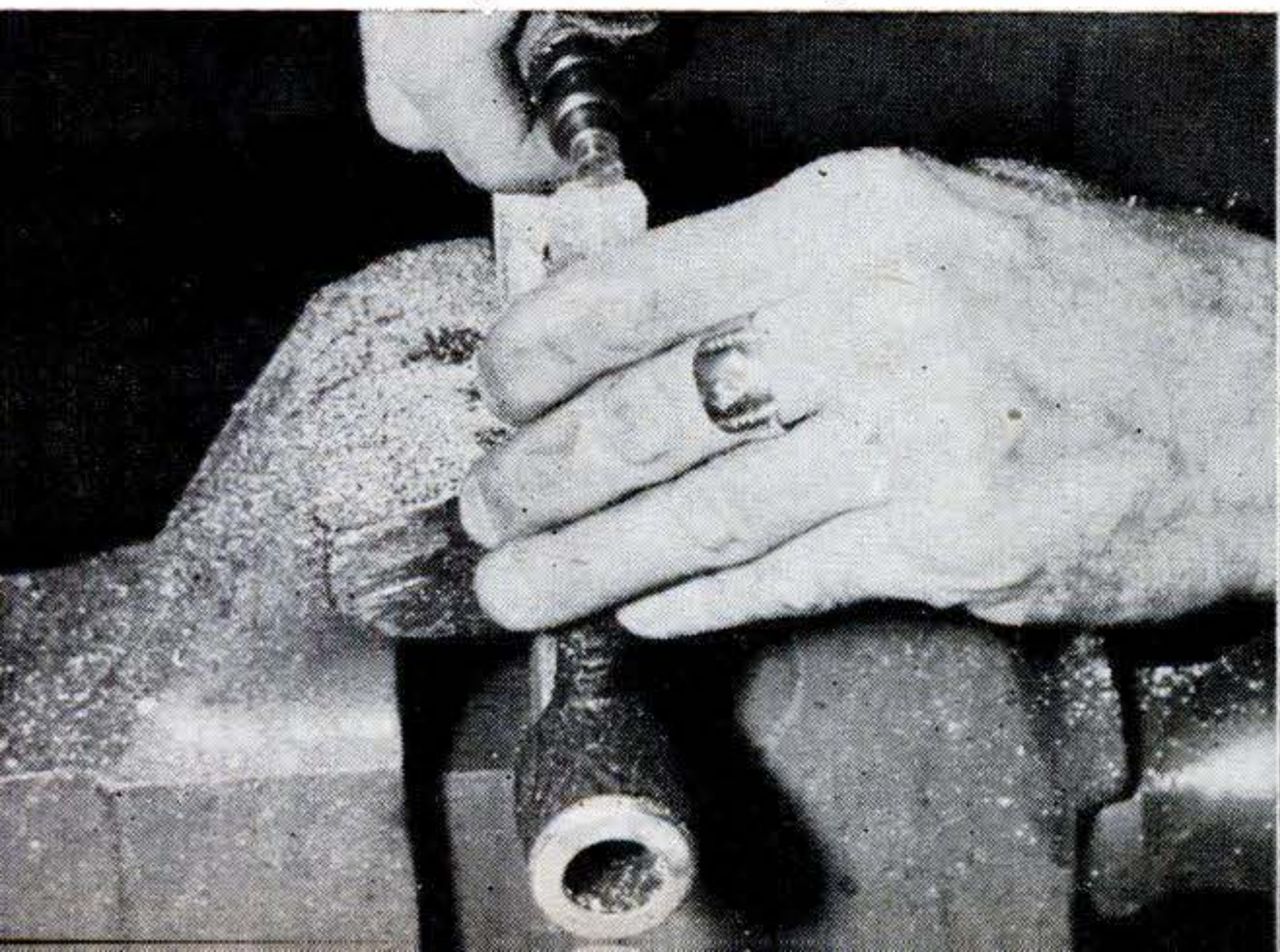
Measure the tenon of the old stem or the hole in the shank and turn down the plastic tenon until it is slightly larger than the measured diameter. Fit the tenon by trial, filing or sanding it until it enters with no more force than is necessary to insert the stem of a new pipe.

Cut a slit in the lip of the stem with a ⅜″ circular saw in a hand grinder and rough-shape the new stem on a bench grinder. Leave the pipe and stem assembled so the job may be viewed as a whole. Use a fairly coarse stone for rough shaping. A time-saving trick—if you're working with clear plastic—is to polish the lip end first. Then you can look into that end and see the depth of the cut as you grind.

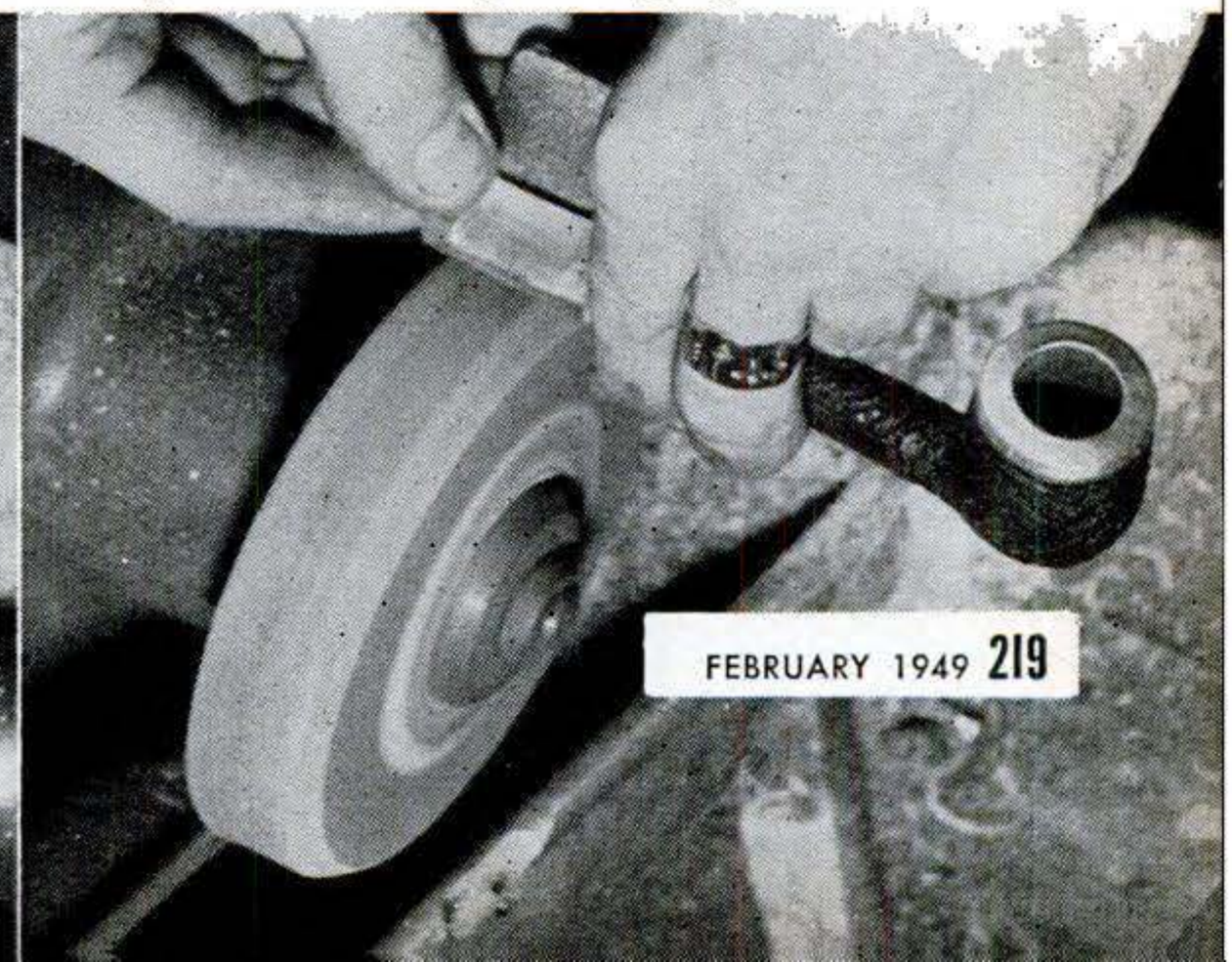
For final shaping and for removing excess material because of an off-center shank hole, use a file and a hand grinder with an abrasive drum. If you want a curved stem, drop the semifinished job into boiling water. Most plastics will become pliable in a few minutes. However, you'll have to work fast because it usually rehardens quickly. Pick the stem from the water with pliers and bend it. If you don't get the curve you want the first time, try it again.

Scrape off file marks with a sharp knife and smooth it with fine emery cloth. Polish the stem on a cloth buffing wheel, wipe off the buffing compound, apply a thin coat of hard wax, and polish with a soft cloth.

7. If you like a slot in the lips of your stems, cut it carefully with a ⅜″ circular saw chucked in a hand grinder. Feed against rotation.

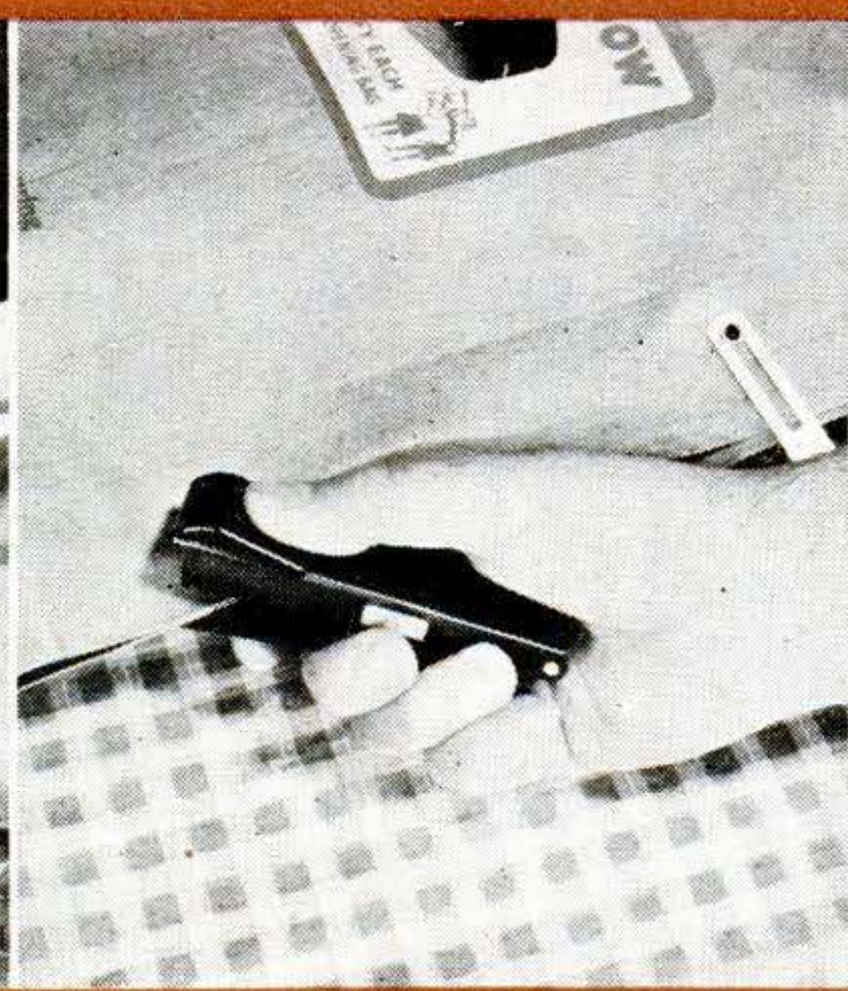


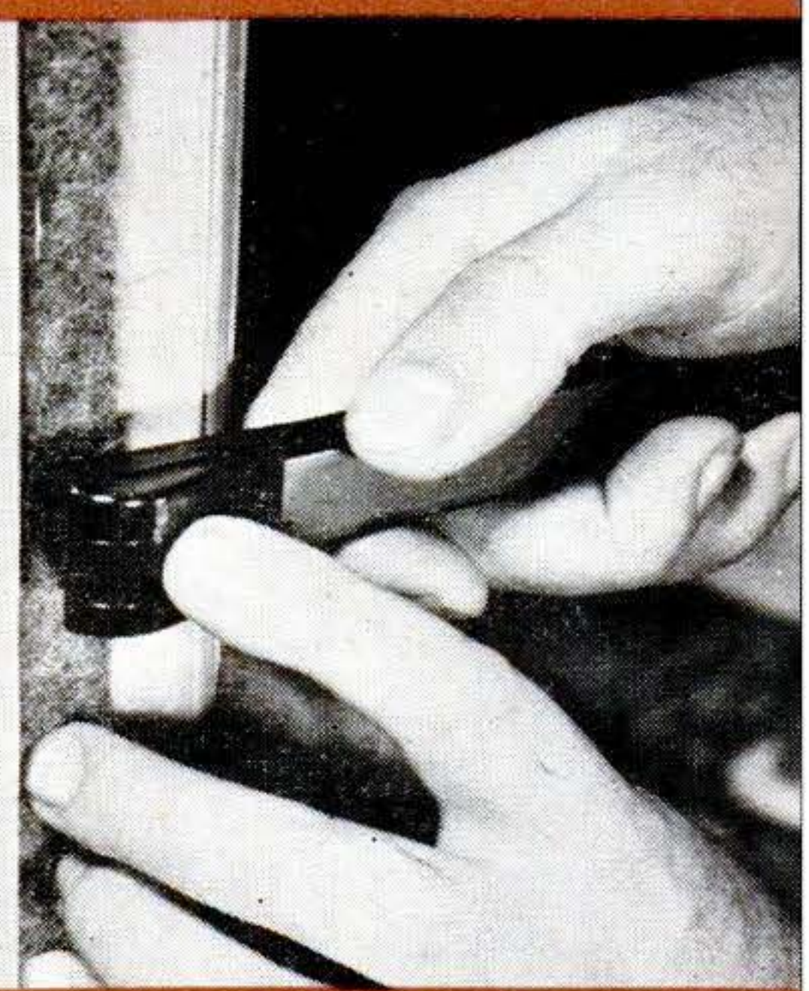
8. A coarse wheel is good for rough shaping. Change to a cloth buffing wheel and buffing compound for the polishing operation.



Putting a Stapler to Use at Home

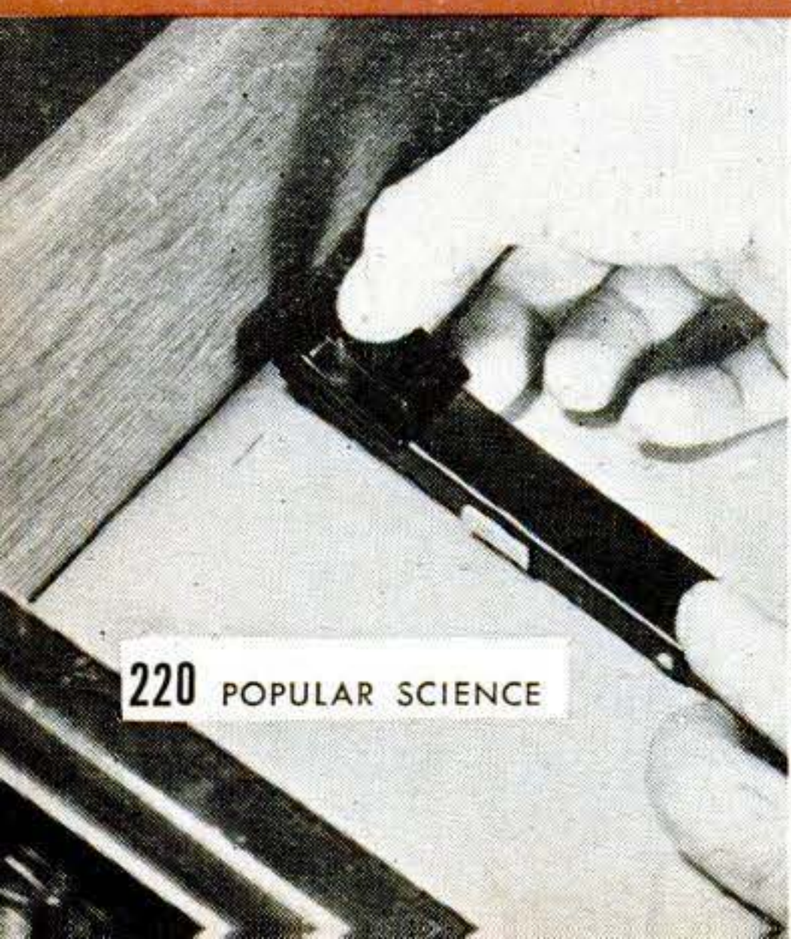
Versatile and easy to use, the stapler is a ready-made substitute for tacks, pins, string, tape, and glue in dozens of light fastening jobs around the home and shop.

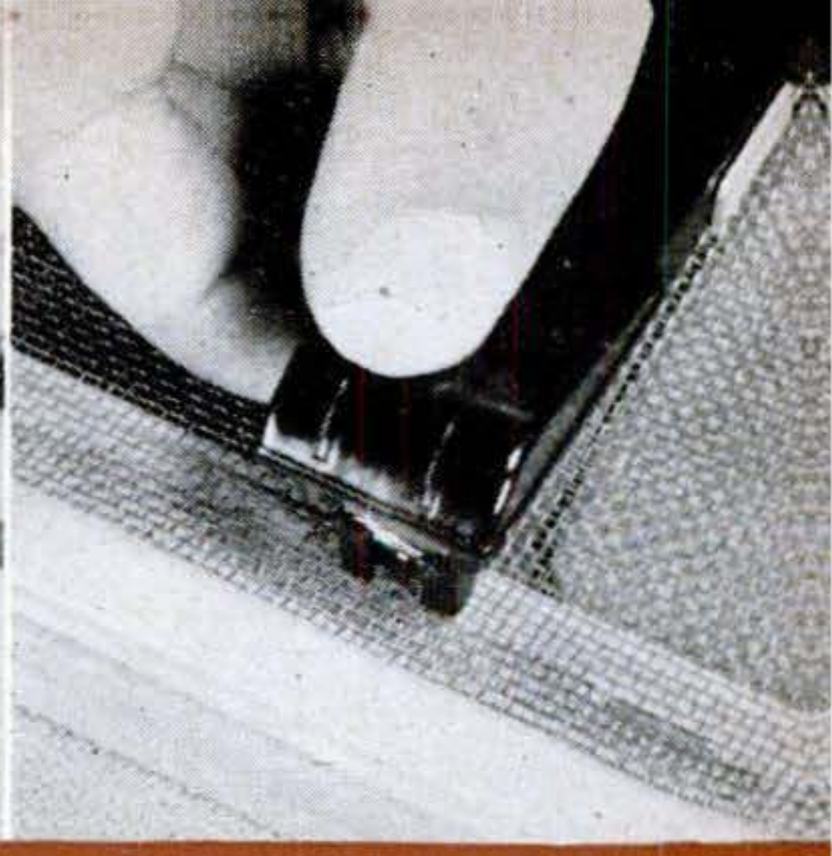




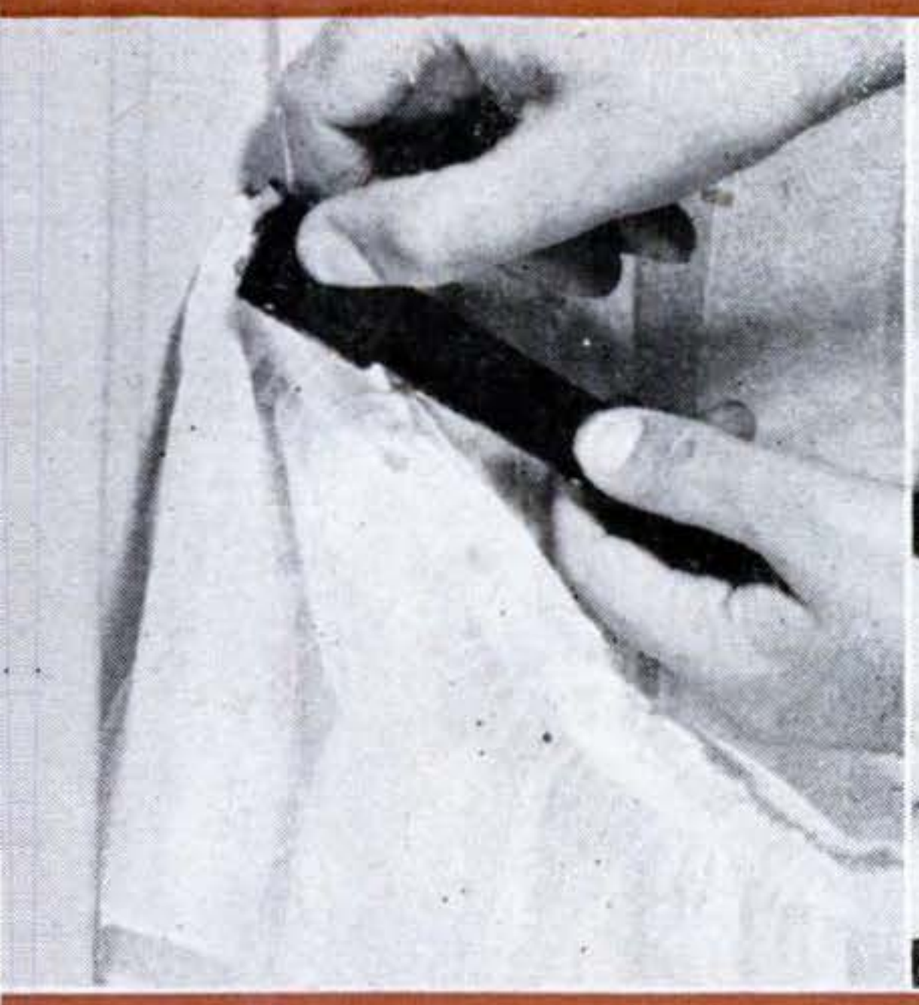
Sealing the tops of paper bags for lunches is no guarantee that Junior won't dip into the cake before the noon recess. However, stapling does make the bag neater and easier to carry. The same idea can be applied to mothproof paper bags with faulty fasteners, center photo. In this case, though, space the staples closely along the edges and top of the bag. Felt weatherstripping can be tacked on the sides and tops of windows with a stapler, and the huskier kind of stapler will even anchor the metal type of weatherstripping along doorsills.

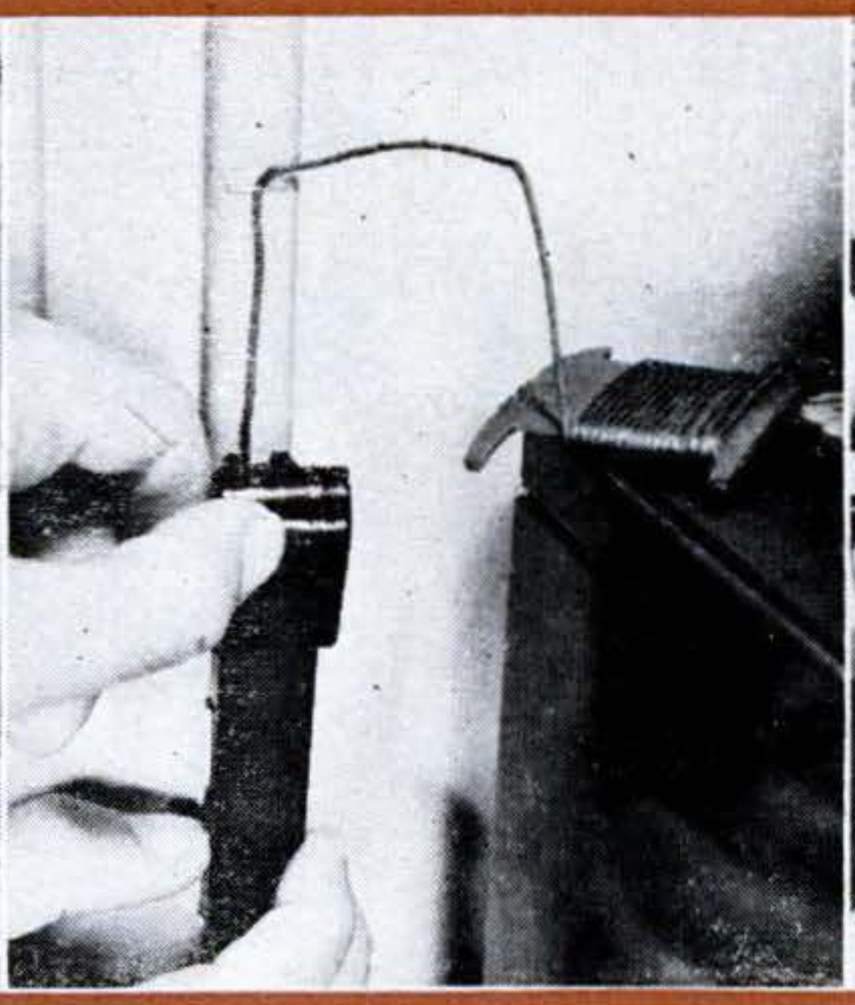
Lining bureau drawers or cupboard shelves with paper or oilcloth is a cinch with a stapler. It's easier to use than thumbtacks, and when you want to replace the paper, just rip it out. You can put in the new lining without bothering to remove the old staples. When it's time to replace torn or discolored window shades, it's money in the bank if you use a stapler. Instead of buying new shades and rollers, get only new shades and tack them to the old rollers. At right, metal seam binding for linoleum is being stapled in place as molding on a table top.

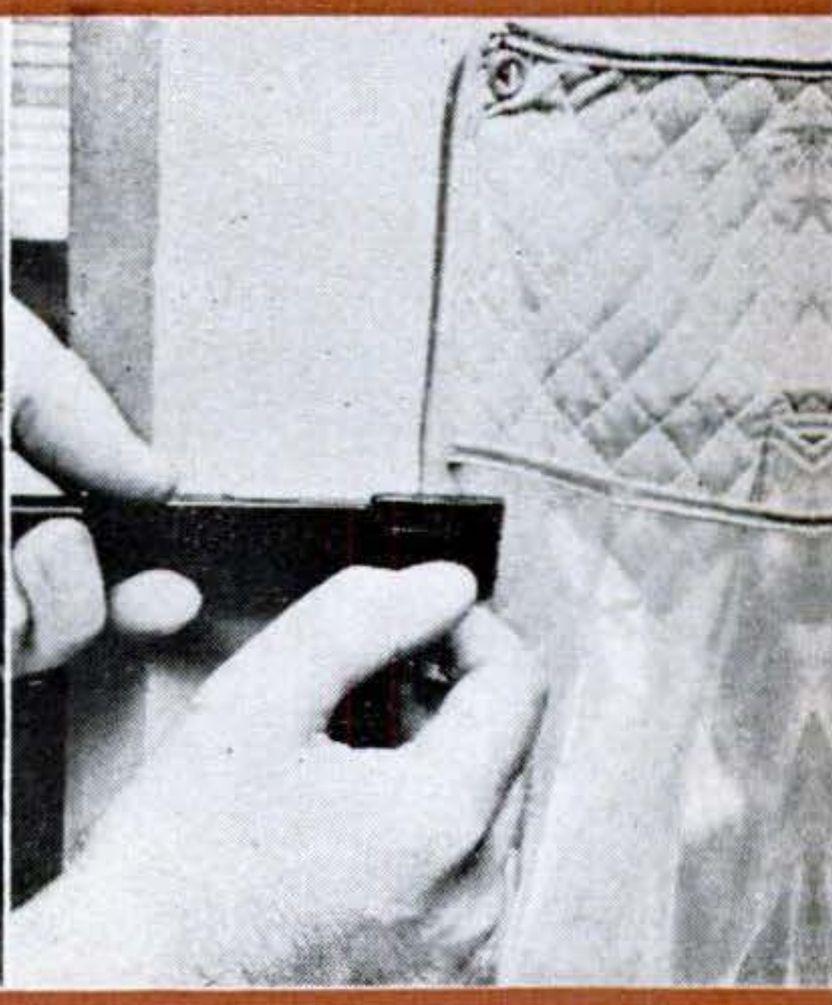




Radio builders or others who experiment with electric circuits will find a stapler a timesaver. Instead of screwing down sockets, transformers, terminals, and other parts, tack them to a bread board. Staples will hold parts if the bases are not thicker than ⅛". A photo album is another spot where you can use a stapler to advantage. The pictures will lie flat and yet they can be removed easily. When you take the screens out of storage this Spring, have a stapler handy for putting on patches, repairing, or for tacking on complete new screening.

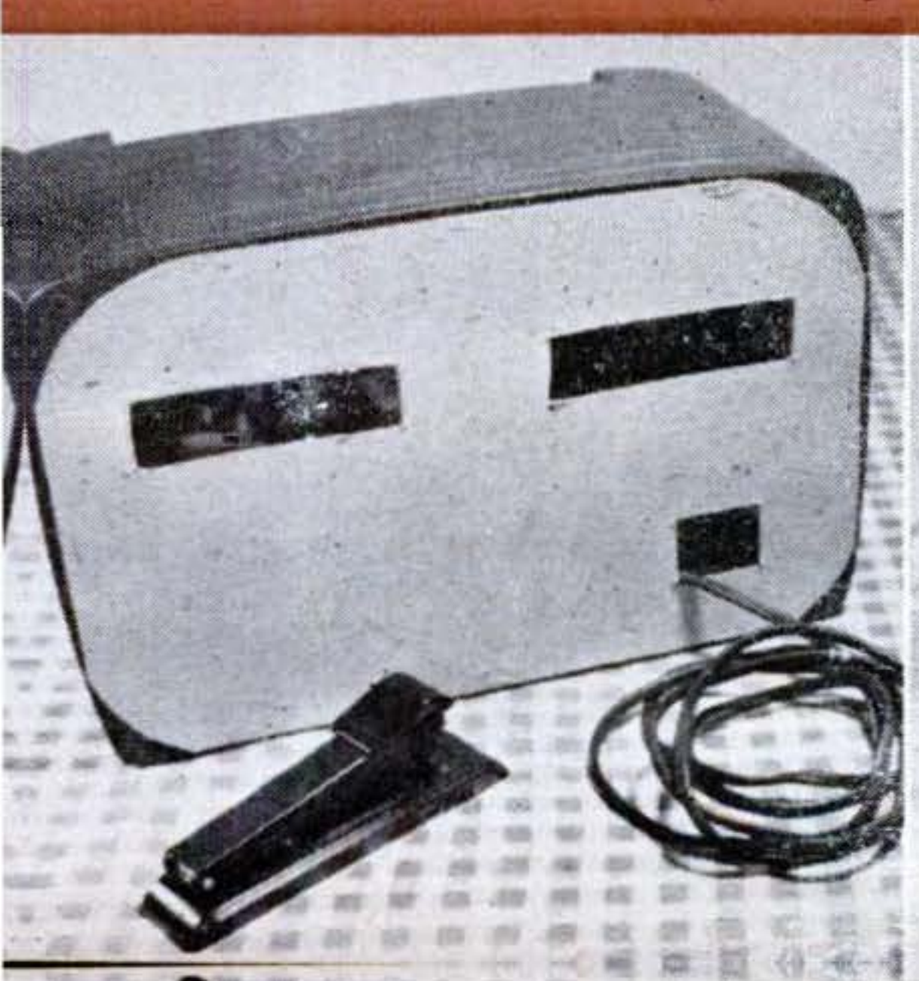


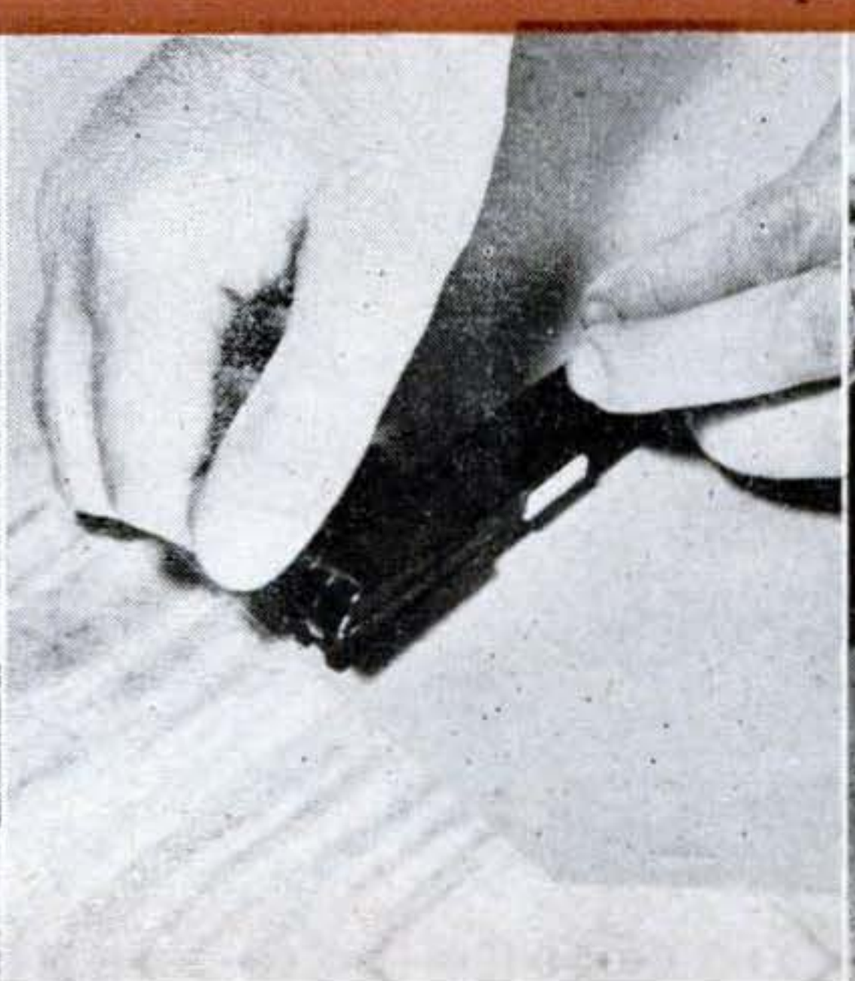




Hold curtain tiebacks with staples. They are as secure as thumbtacks and won't make conspicuous holes in the woodwork. An aerial lead-in that droops along the baseboard is a nuisance. Pin it up with staples. You can do the same thing with doorbell or other low-voltage wire. The photo at right shows a shoe bag being stapled to a closet door. This is an especially good dodge if the center of the door is paneled with thin wood that might be pierced by nails or screws. Space the staples 2" or so apart on top and a bit further on sides.

If the composition back of a small radio is damaged, keep dust out with a new one cut from a shirt cardboard and staple it to the back of a wooden cabinet. Leave ventilating holes. Blotters will stay put—center photo—on a worktable or desk if they are pinned down with staples. In the same way you can protect a bench top or kitchen table with wrapping paper. Shelf edging slips into place in a hurry when it is tacked down with staples, as in photo at right. Snap a staple through the edging about every 3". The smaller stapler will handle such jobs.



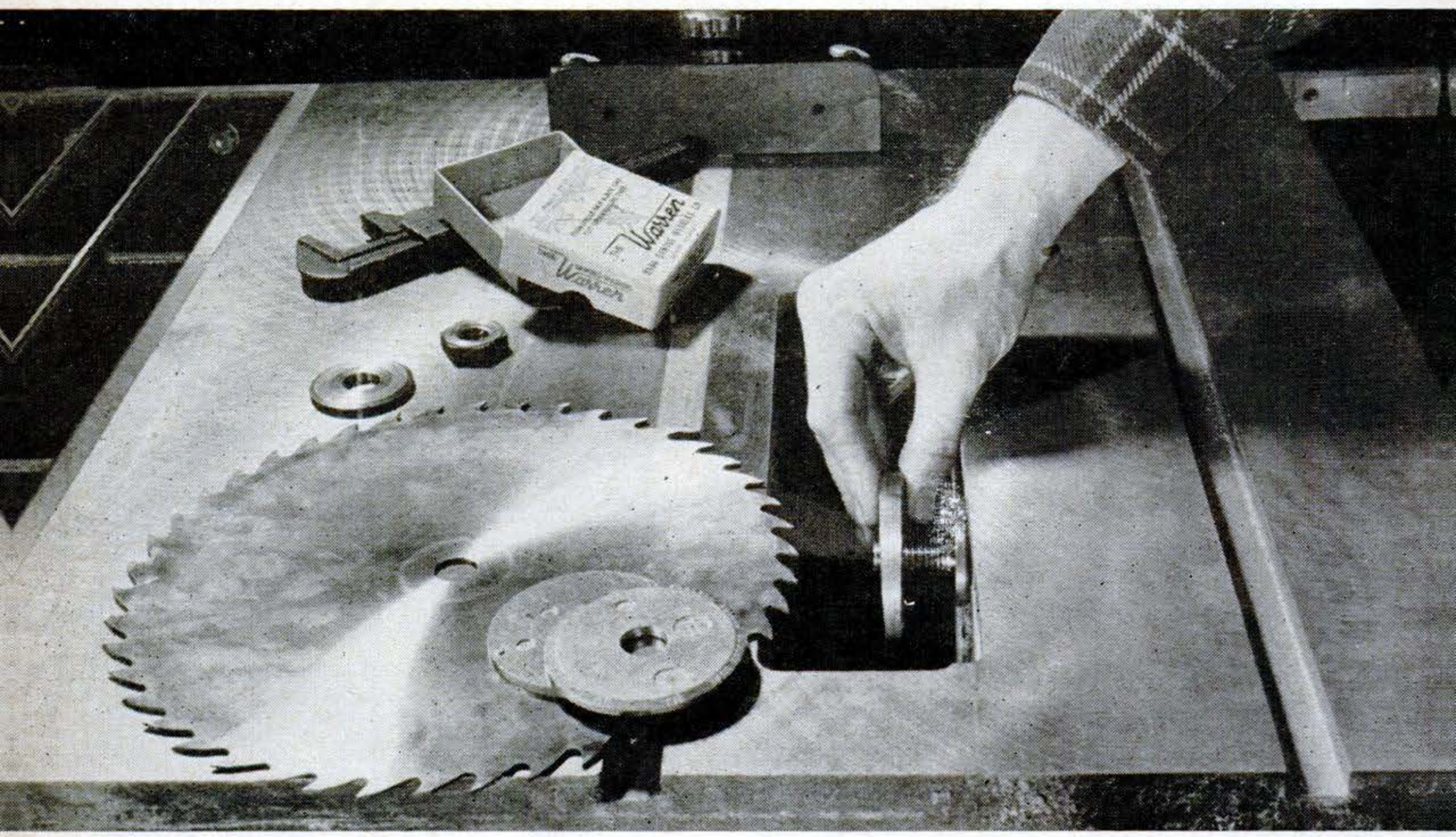


How Wobble Saw Works

PS photos by Hubert Luckett

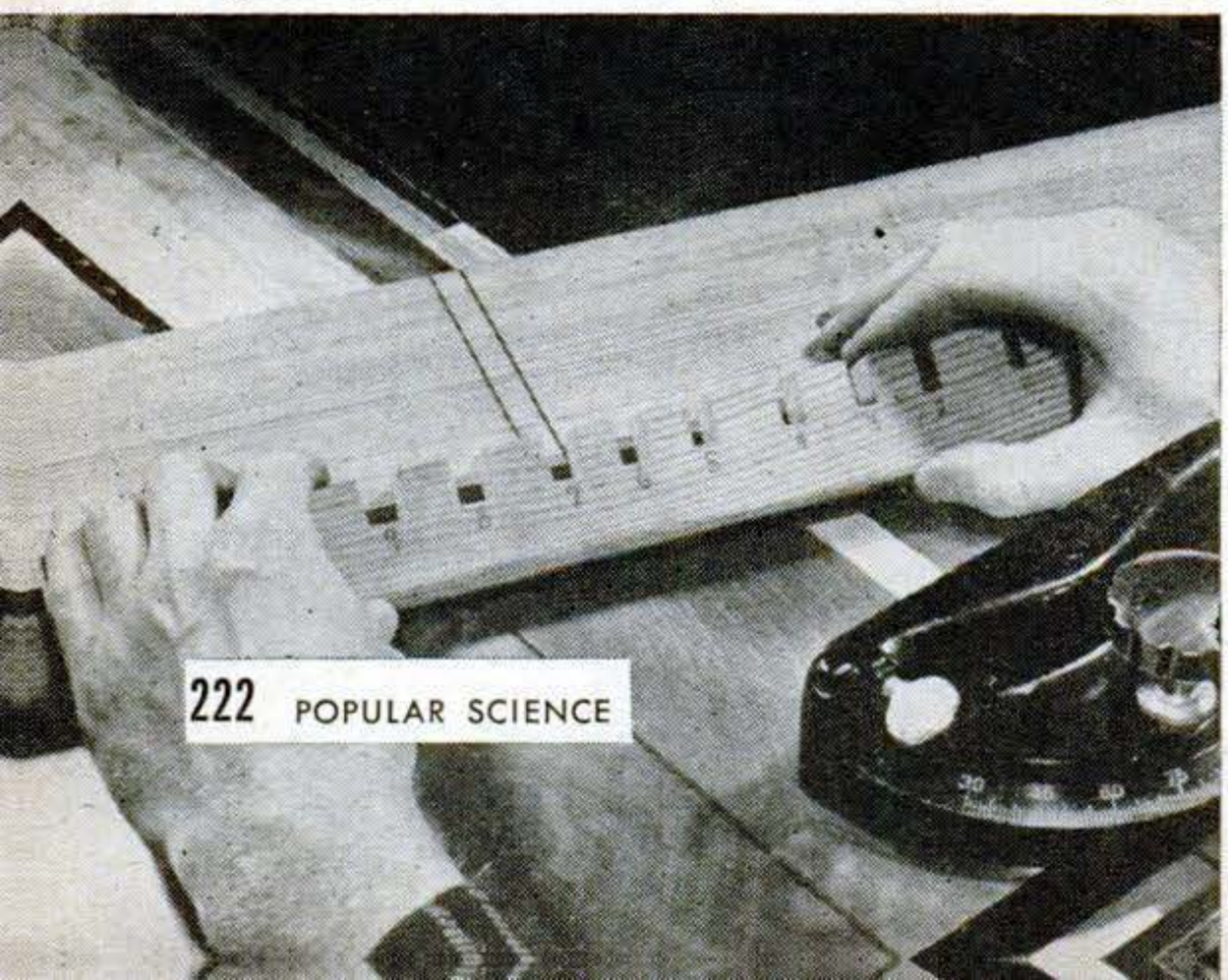
In a previous article on grooving and rabbeting (PS, Nov. '48, p. 204), a statement was interpolated in the text that "the edges of a groove or dado cut with a wobble saw will be angled unless it is made in a series of shallow cuts." This statement, based on insufficient experience with this particular equipment, was incorrect. To protect readers who rely on the usefulness of this magazine, Popular Science publishes these actual shop photographs demonstrating the possibilities of the ingenious device by which a round saw cuts a square slot.

CUTTING a groove (a slot that runs with the grain) or a dado (one that runs across

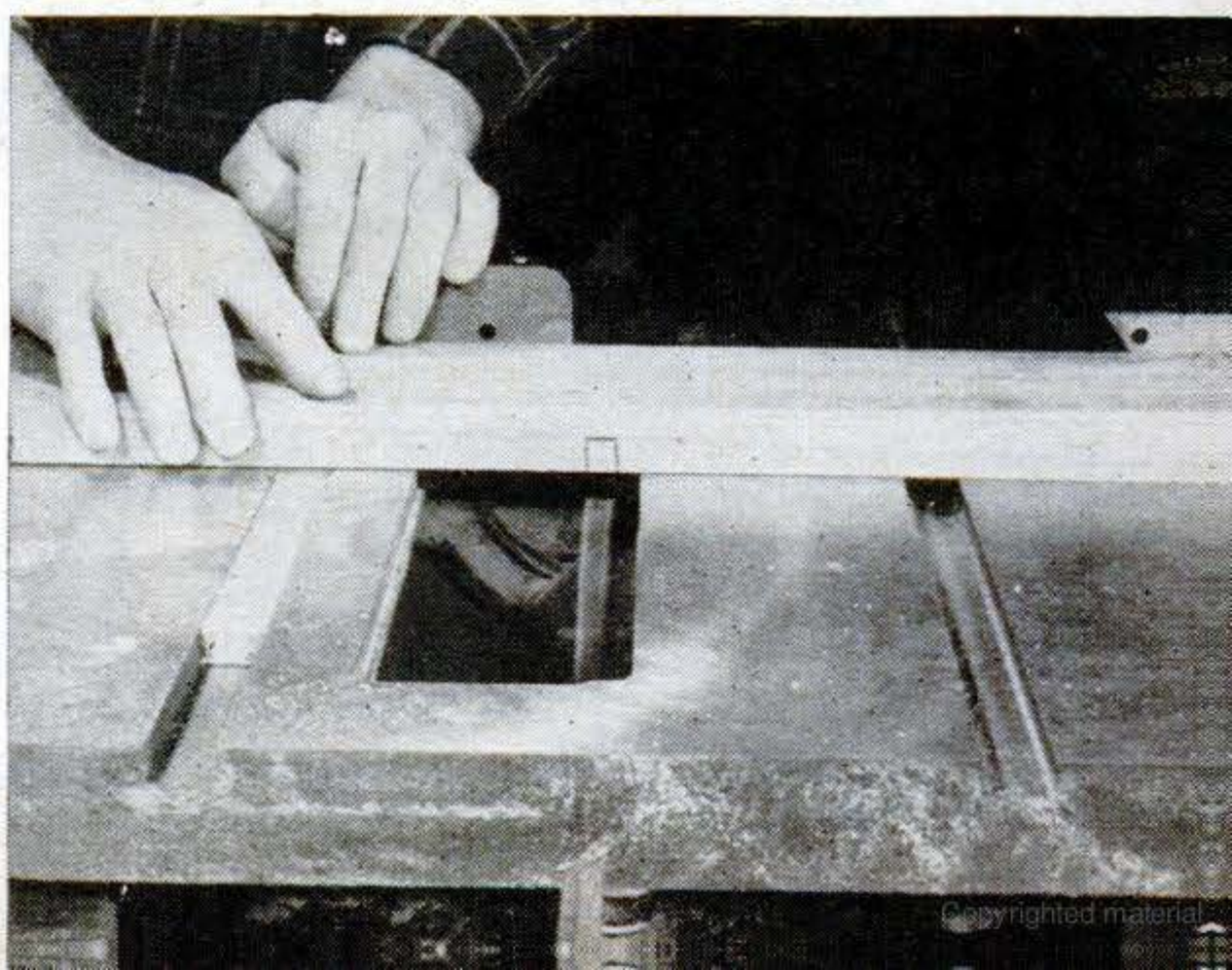


Two wobble washers are slipped on the arbor of the saw, then the blade, and two more, followed by regular washer and nut. On the 10" saw shown, these wobble washers will give 12 different dadoes ranging from ⅛" more than the blade thickness up to a cut that's ⅝" wide.

A dado gauge is held against the marked-out stock to determine the proper washer setting. Then each pair of washers is set and the nut tightened. The washer pairs are also aligned.



A single pass then cuts the dado. Note square-cornered blurred image of blade. The work is located by rip fence, which is positioned after trial cut is run in a piece of scrap stock.



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it) is a tough job if you work by hand. On a circular saw, you can do it with one fast pass—and the resulting square-cornered slot permits an unusually strong joint for bookcases and other woodworking jobs.

There are two ways to cut grooves and dadoes on a bench saw. One is to use a special dado saw—a pair of stiff circular-saw blades that are spaced apart on the arbor by rotary knives called "chippers." Another is to use a set of the comparatively new and inexpensive "wobble washers" with your regular saw blade. These work by deliberately throwing the blade out of its true line, the degree of wobble determining the width of the cut.

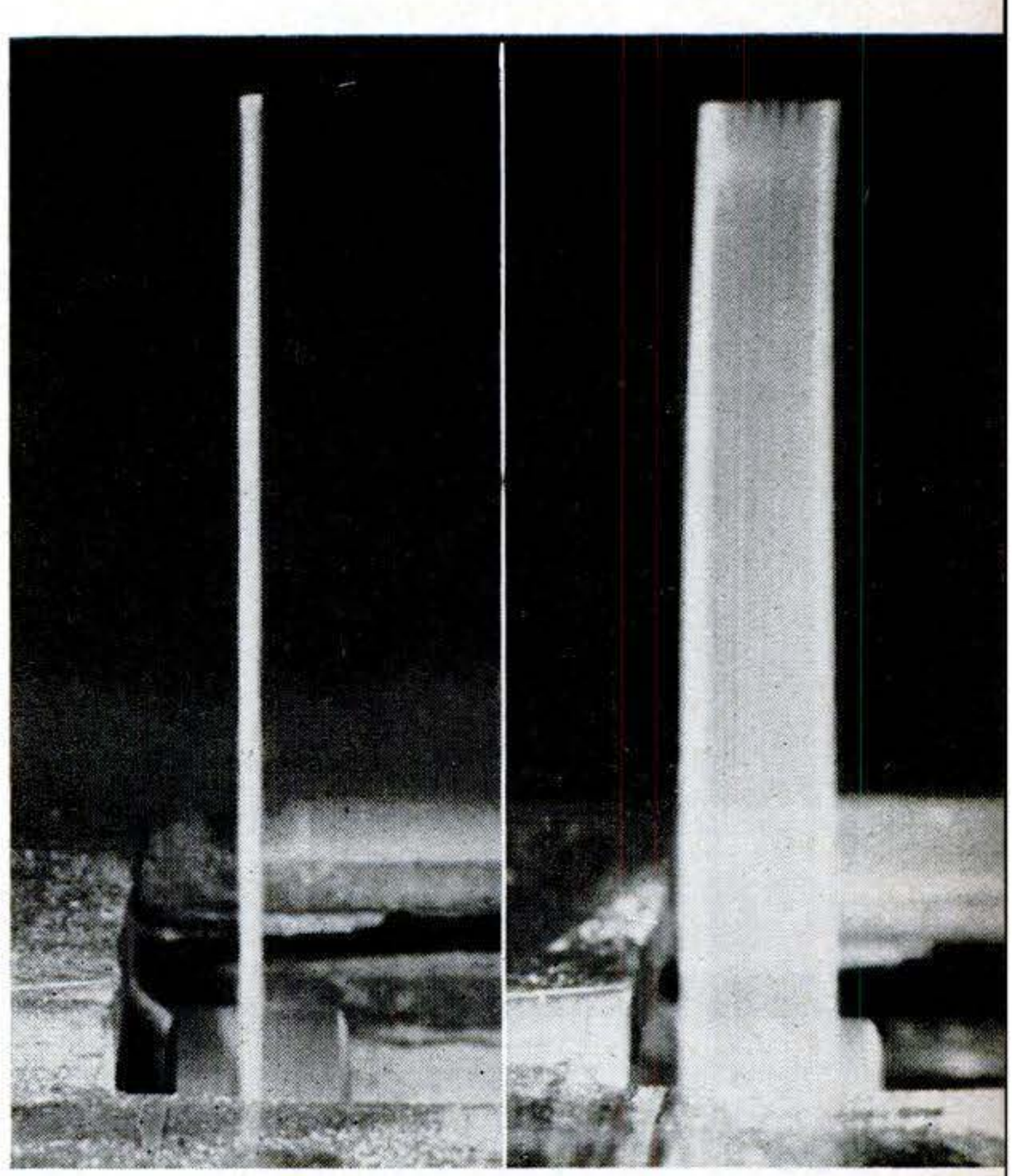
A set of wobble washers consists of four metal disks, two mounted on each side of the saw. (Four rather than two are used to present square surfaces to the shoulder and lock nut, and to allow adjustment.) Different settings between each pair of washers give different degrees of wobble to the saw. In setting up, you need only be sure that both pairs of washers are adjusted identically, and that both pairs bear the proper relationship to each other.

Best way to locate a piece of stock so the groove or dado will be cut in the right place is to make a trial cut in scrap first, using the ripping fence as a reference. If you try to locate the work by reference to the stationary blade, allow for the fact that the amount of wobble—and hence the apparent width of the cut—decreases a trifle when the saw is running. Centrifugal force causes the blade to straighten a small but appreciable amount.

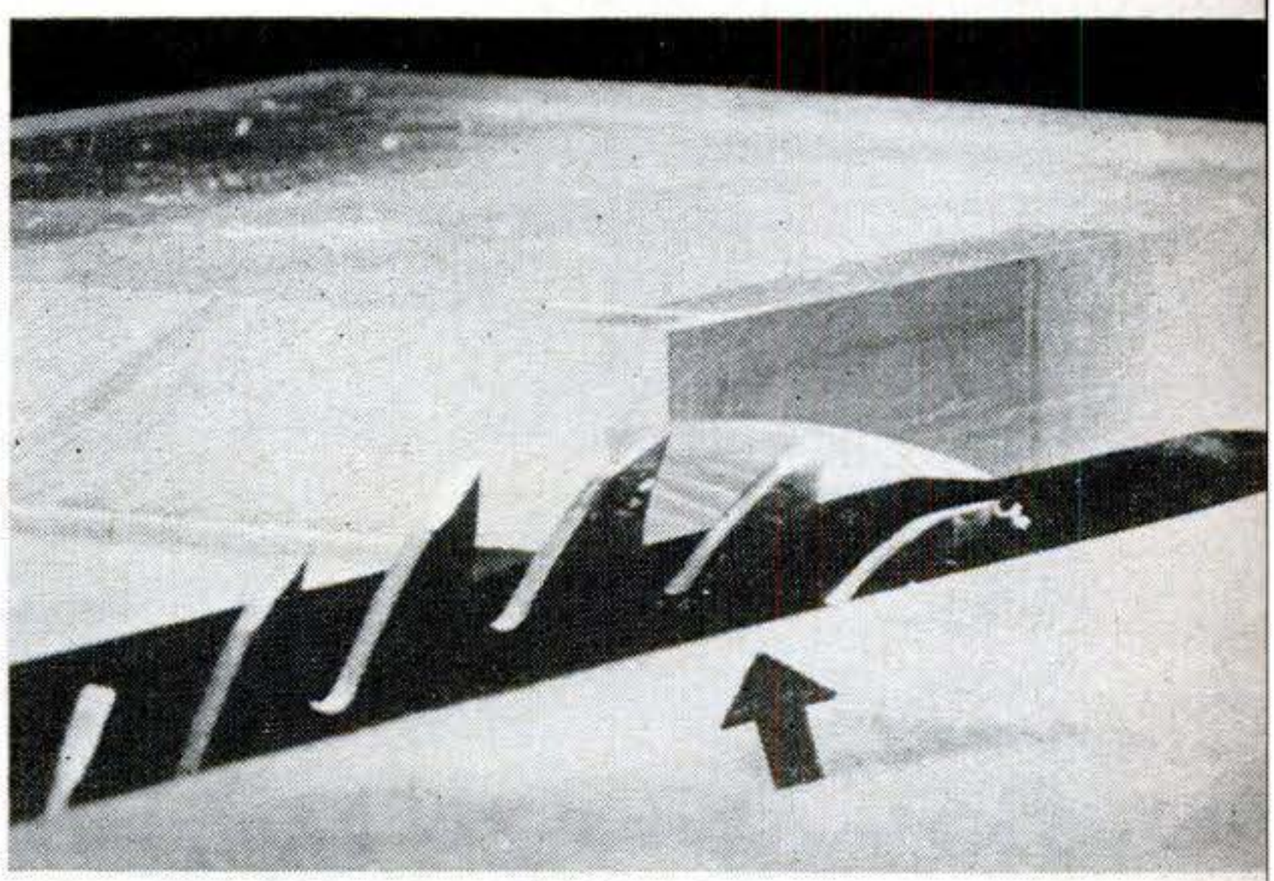
Never shut off the motor during a cut. If you do, the slowing blade will spread, scarring the sides of the slot. If you wish to make a stopped dado, lift the work off the blade while the motor is still running.

It'll be a convenience if you make a notched dado gauge. This is a ¾″ by 2″ by 18″ piece of stock, with a dado cut at each washer setting and numbered accordingly. This gives a quick guide.

When you change the saw setting, always rotate the blade by hand once or twice to make sure it won't strike the table.

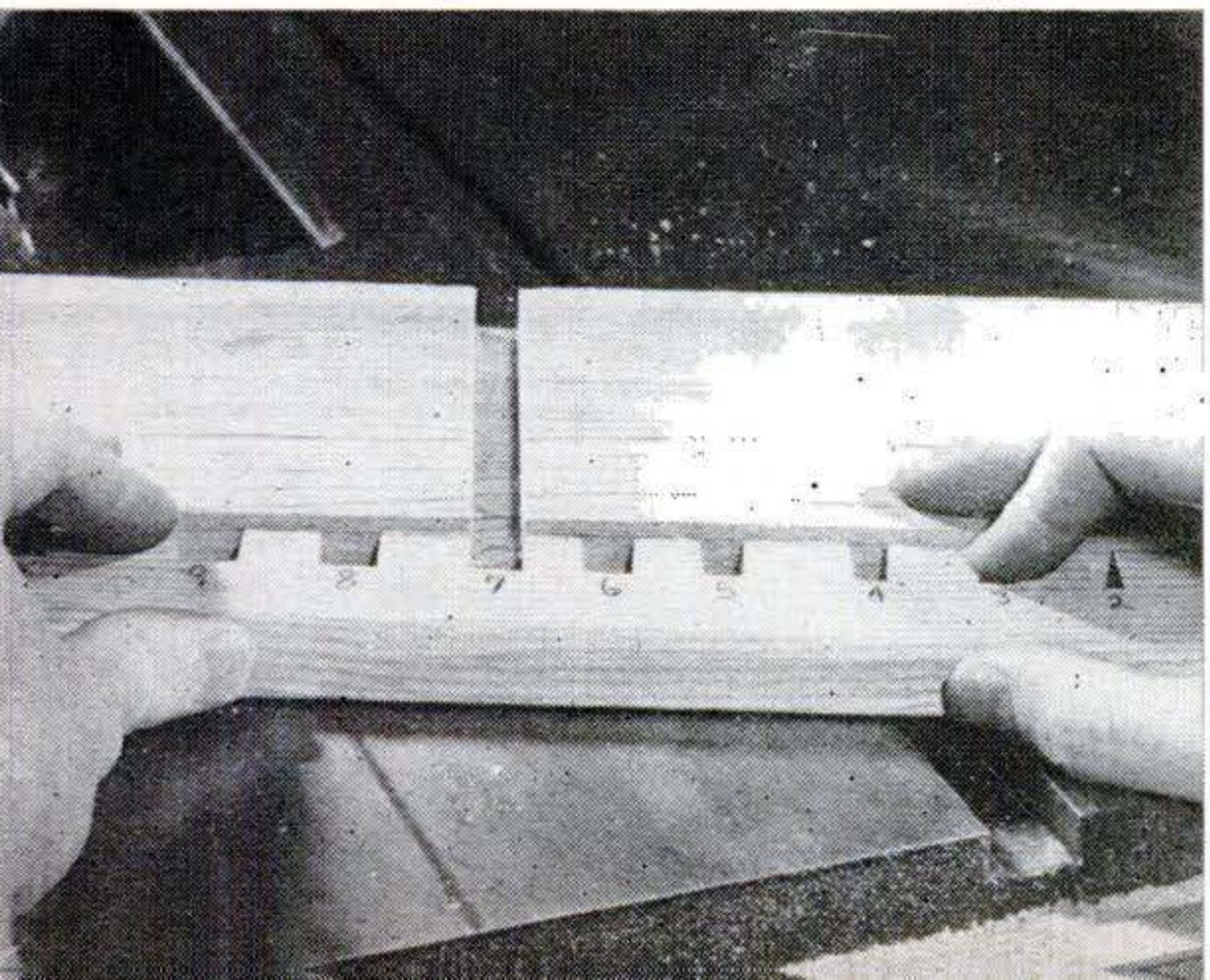


True and wobble. Both pictures above show a blade turning at 3,700 r.p.m. At left, the washers are set at zero wobble; at the right, they're adjusted to give the maximum wobble.



Cutaway shows why dado is square. Tooth marked is one farthest left, whether at top of cut or edge of cut. This tooth describes a circle in a plane that is 90 deg. to the saw arbor.

Final check shows the dado is straight, square, and exactly to size. Bottom of a wobble-cut dado is as smooth as, or smoother than, one cut with regular dado saws and chippers.



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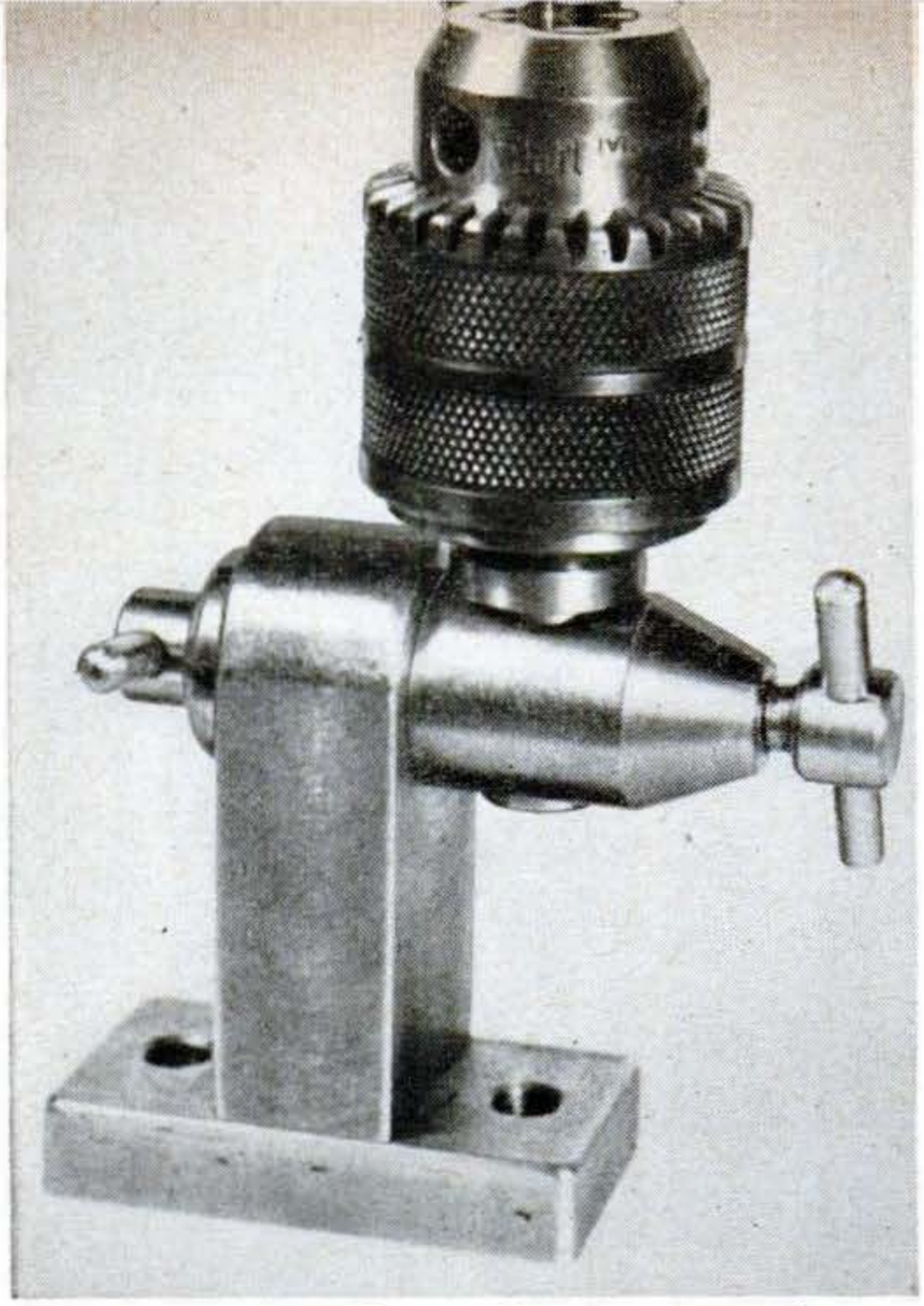
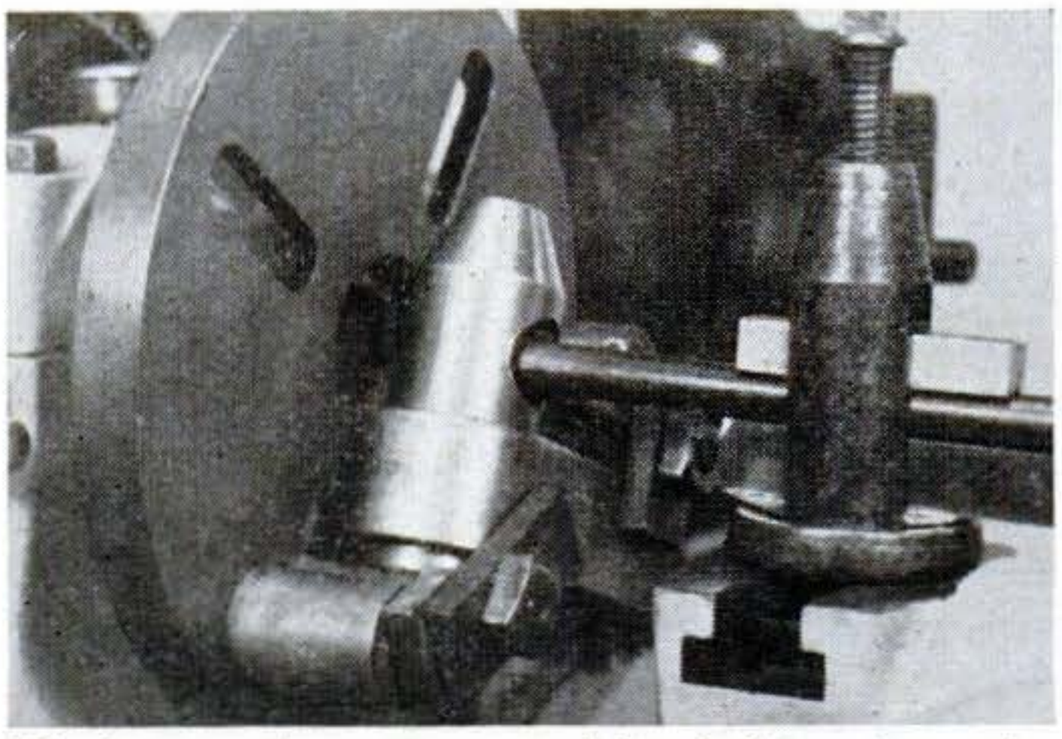


Chuck turns 360 deg. and swings 180. The two thumbscrews lock it in any desired position.

Vise is ideal for filing, since the work can be swung to most convenient working direction.



Machine a bore in swivel by bolting it to the body and then clamping latter to the faceplate.

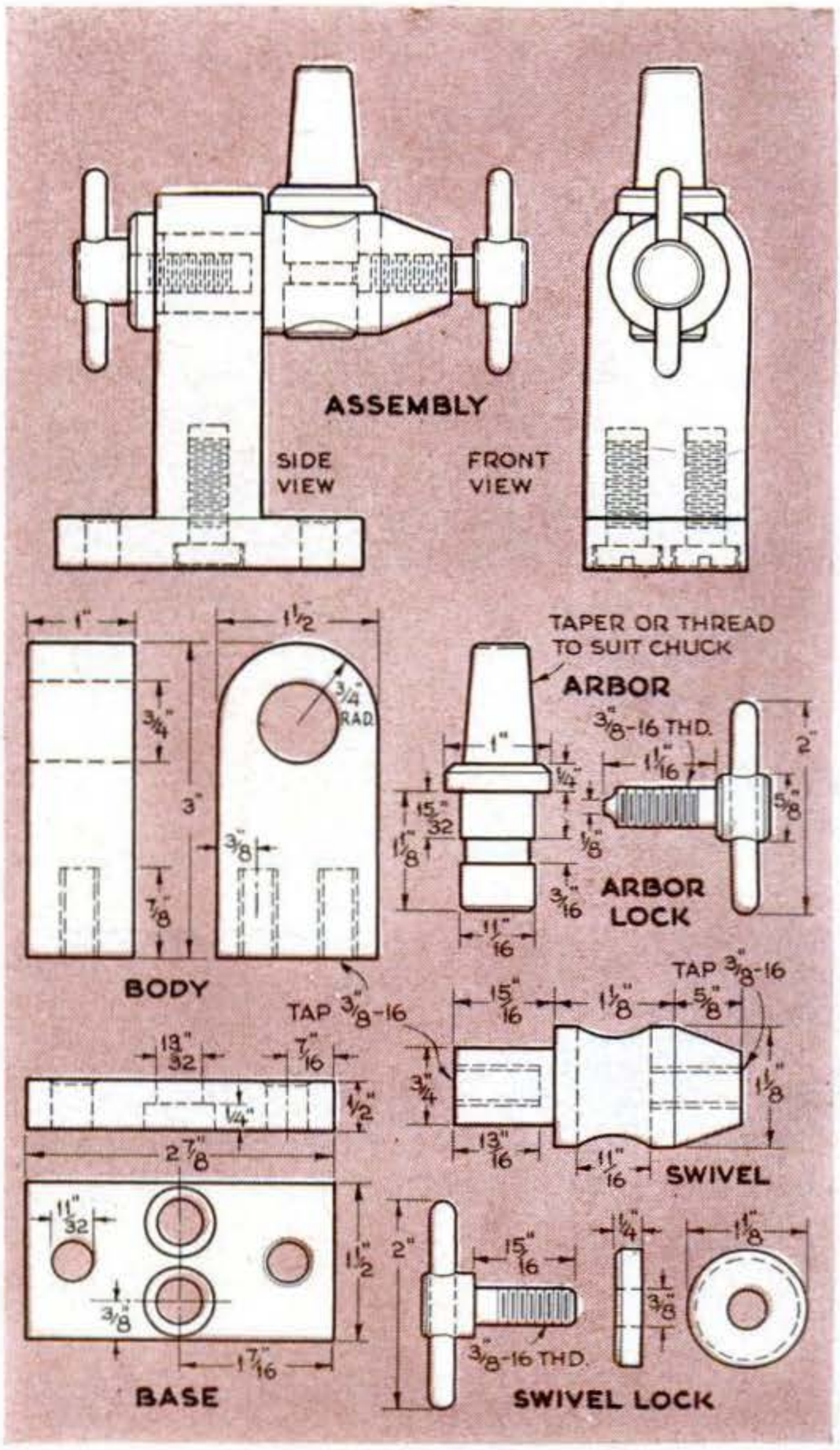
Bench-Mounted Pin Vise Built from Old Chuck

DON'T throw away that old drill chuck. Here's an excellent use for it. Even though the chuck has a bad run-out, it doesn't matter a bit. The only requisite is that the chuck grip the work.

Of course, you can put your best drill-press or lathe chuck to work in the same way. Just mount it temporarily on the vise assembly when needed. However, you'll find it more convenient to have the chuck permanently mounted, and it probably isn't good to use an accurate chuck in this way.

All parts are made of cold-rolled steel. Dimensions and assembly are shown in the drawings. The only part that requires precise machining is the tapered chuck arbor. You can form the radius on the top end of the body by drilling a series of tangent holes on a semicircular line and then grinding off the waste. Clamp the body on the lathe faceplate to machine the transverse bore for the swivel. Machine the bore in the swivel as shown in one photo.

Mount the vise on the bench with 5/16" bolts.—*John A. Bates, Wise, Va.*



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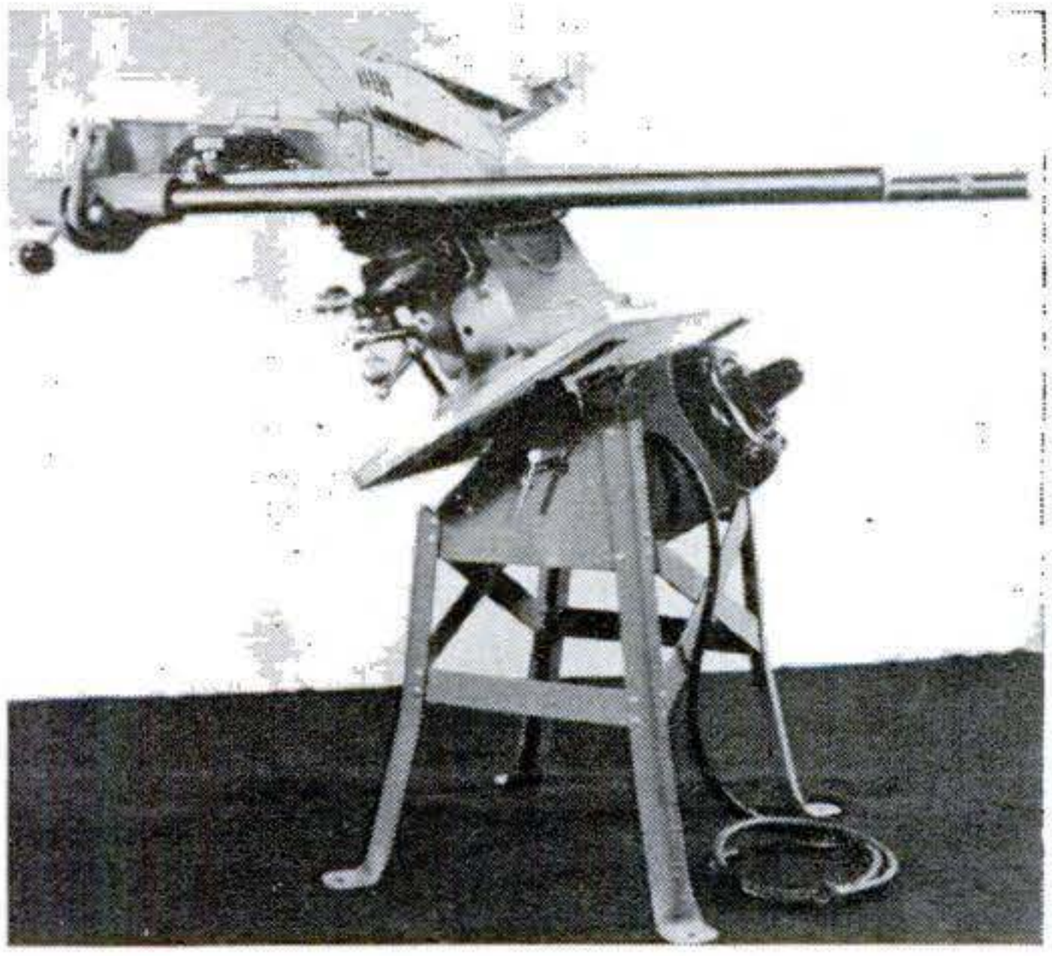
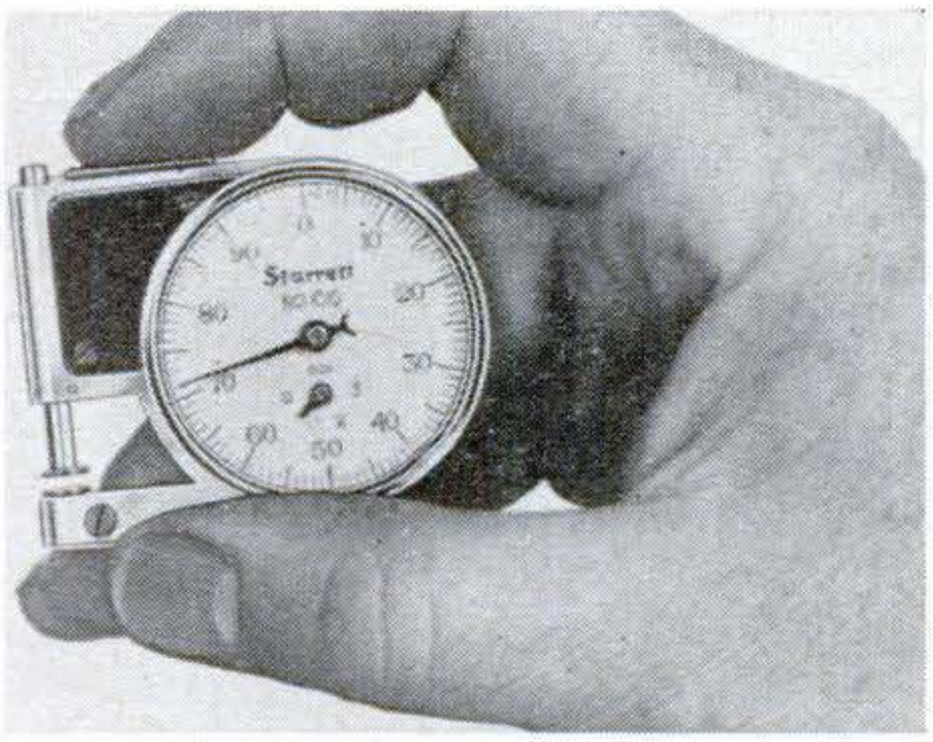
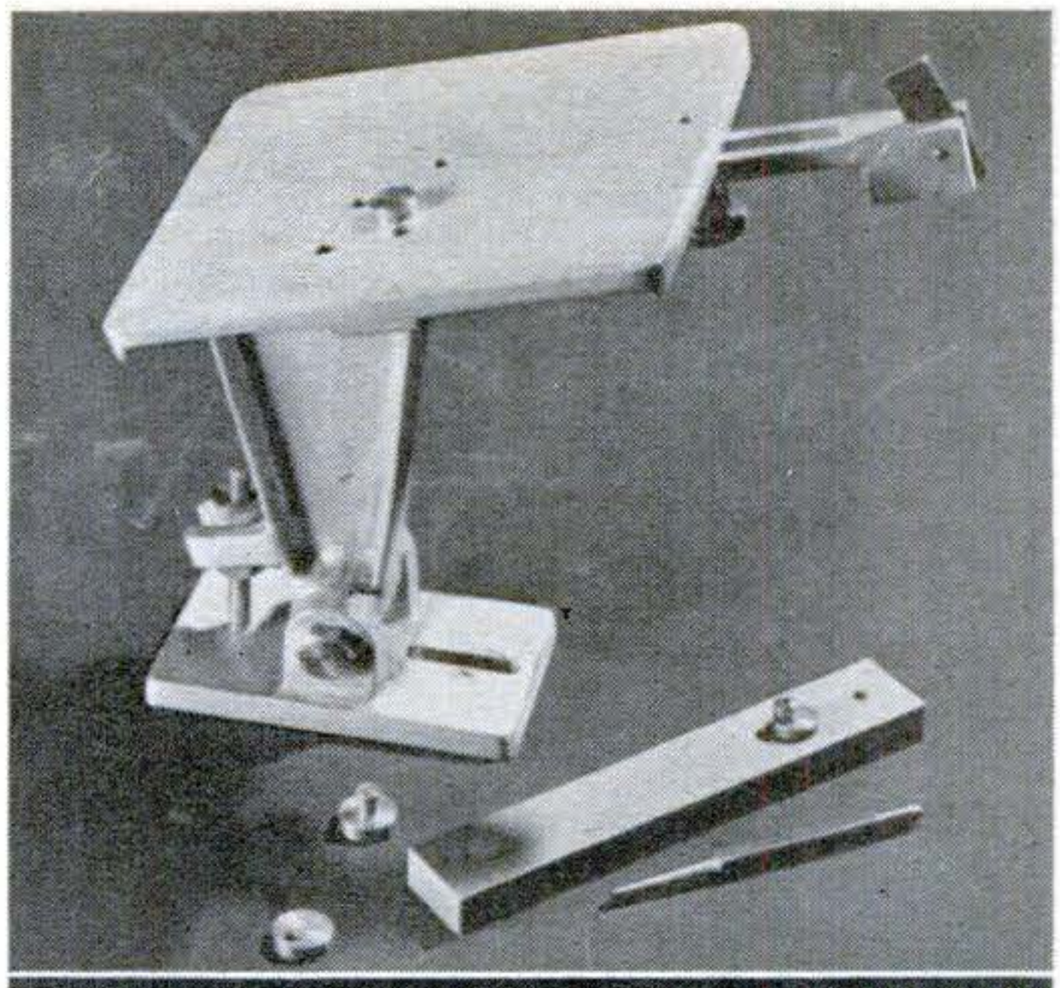
NEW TOOLS

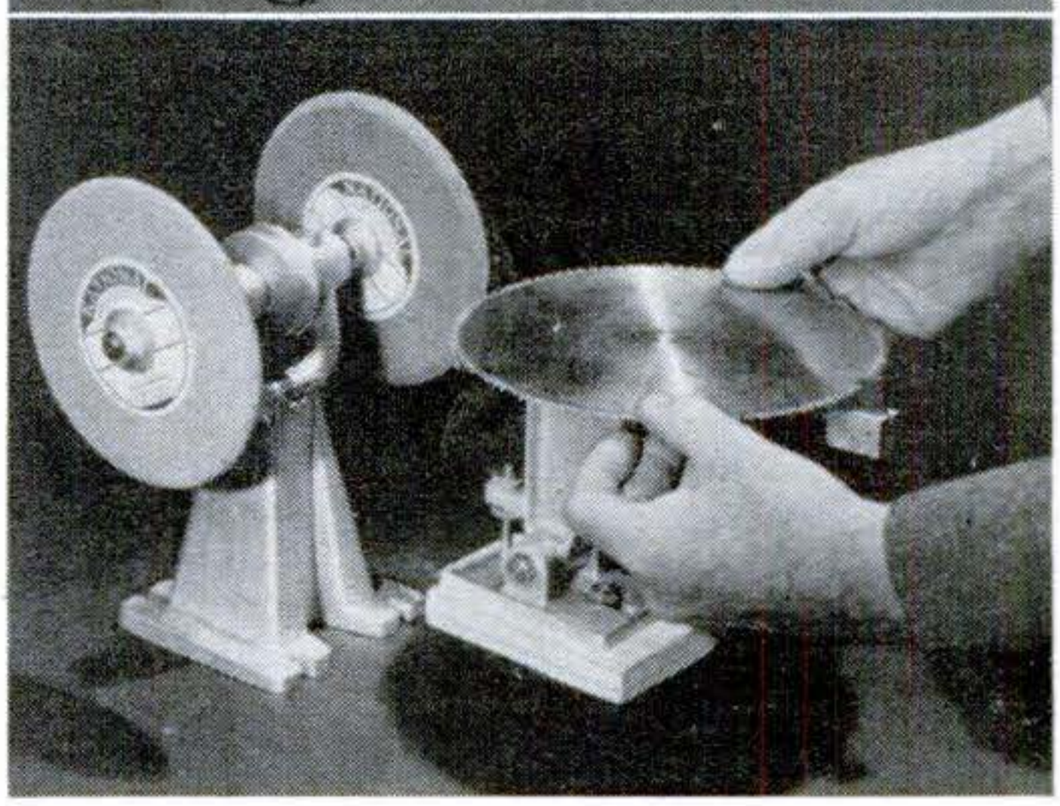


Stand Holds Work Horizontal. This stand, made by the Bush Manufacturing Co., of Clawson, Mich., simplifies work on tilting-table machines. The angular tilt of the machine table is offset by adjusting and locking the Bush Tilt-Top ® table in a level position. It is adaptable to such machines as circular saws, jigsaws, bandsaws, drill presses, and jointers. Dimensions of the table are 16″ by 28″, and height, 25″. The weight is 45 lb. It has cast-iron trunnions in front and rear with screw-type locks and heavy formed-steel legs and braces. The motor tilts with the base of the tool.

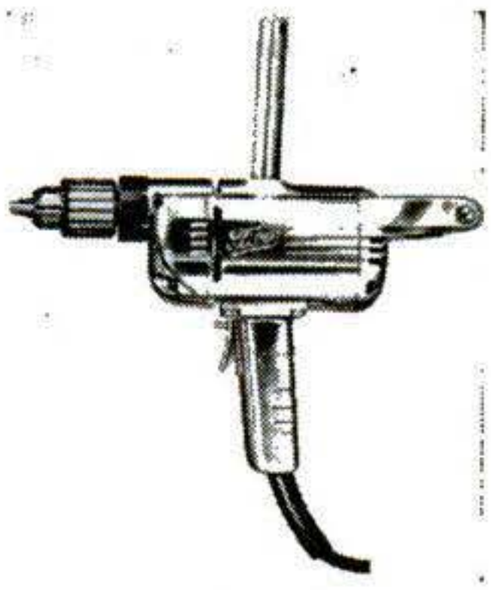


Dial Indicator Fits Pocket. About the size of a pocket watch, this dial indicator measures thickness up to ⅜″ on a dial that is graduated in thousandths of an inch. The smaller hand counts the revolutions of the larger hand. Priced at $15, the indicator is made by the L. S. Starrett Co., of Athol, Mass.





Fixture Sharpens Bench Saws. Provided with centering plugs for saws of various-sized arbor holes, this fixture may be used for sharpening rip, crosscut, and combination saws. An indexing device locks each tooth in position. Two grinding wheels, one with a radius and the other with a 45-deg. bevel on one edge, are also available. The sharpener, made by Treyco Products, Buffalo, N. Y., sells for about $11.



Lightweight Drill. The Thor® portable electric drill is smaller and lighter than the usual ½″ drill, according to the maker, the Independent Pneumatic Tool Co., of Aurora, Ill. It has a trigger switch, Jacobs chuck, and a removable handle that screws into the top when a T-grip is desired for heavy drilling. Switch is in the lower handle. The housings are highly polished, die-cast aluminum.

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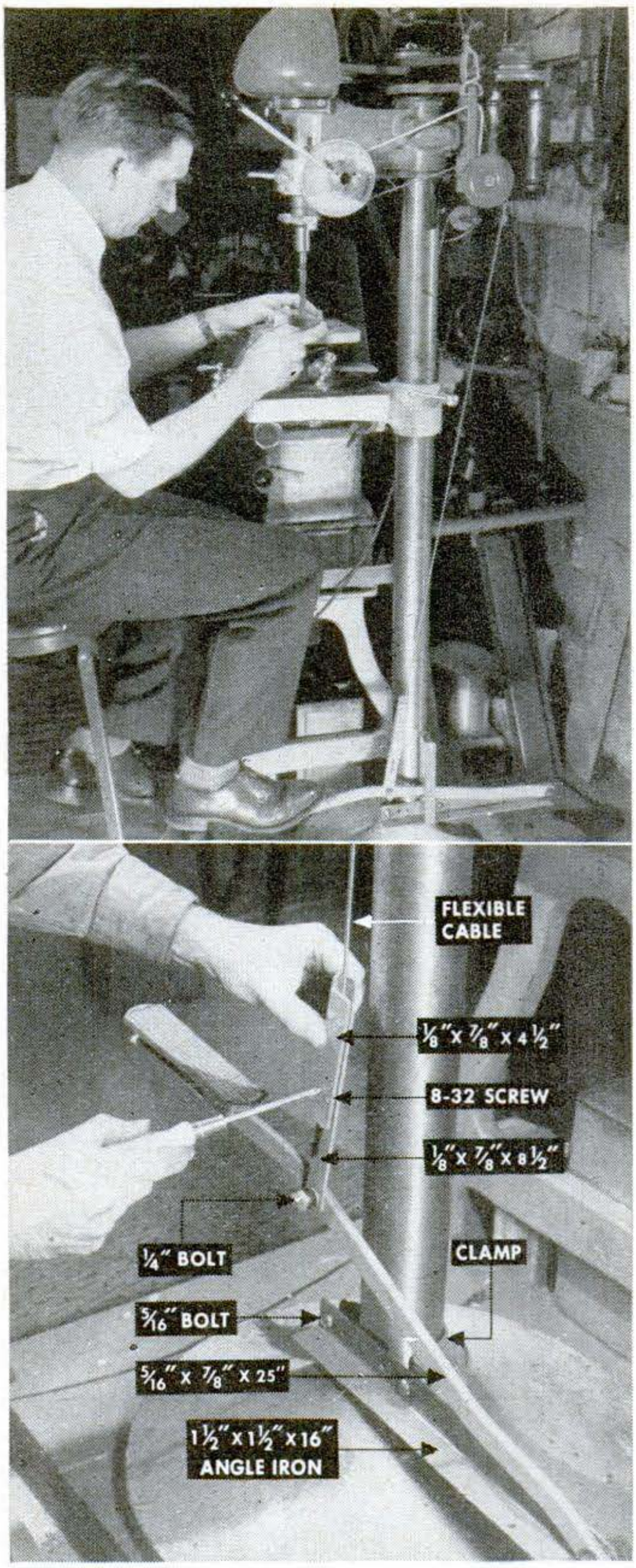

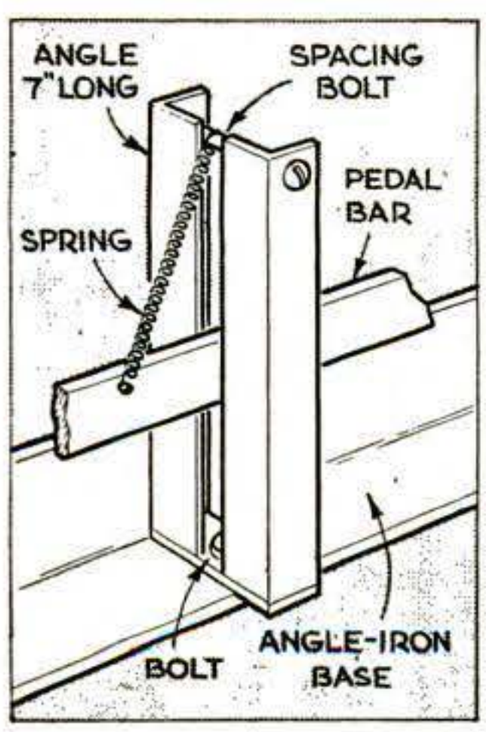

Cable is held between two steel plates at the pedal end. This makes it easy to adjust the cable length, as seen in lower photo. Notice pedal bar is slightly bent to clear bolts that hold angle-iron base to drill-press column. At left is an optional feature. Its purpose is to prevent pedal bar from swinging too far sideways.

Drill-Press Foot Feed Gives You Extra Hand

By Walter E. Burton

LIKE many other accessories around the shop, a drill-press foot feed is something you *can* get along without. But when you once use one, its convenience will probably make you wonder why you've delayed so long.

The feed shown was designed for a floor-mounted press. However, by providing a suitable anchorage for the pedal, it's easily adapted to the bench type.

It consists of three major parts, the foot-lever assembly, idler pulley, and pinion-shaft drive—all connected by a speedometer cable. A chain having non-splitting links could be used instead.

On the drill-press pinion shaft, install a standard V-belt pulley about 5″ in diameter. Use a smaller one if you want more spindle travel for a given foot-lever travel.

Perhaps you can find a pulley with a bore that fits the diameter of the shaft. If so, mount it adjacent to the hand lever.

On the drill press shown, the original hand lever had been replaced by a hub with three ball-end levers projecting from it. The pulley chosen had a ¾″ bore. It was mounted on a piece of shafting held in a lathe chuck and the pulley center cut out with a cut-off bit, leaving a hole large enough to fit the 1¼″ pinion shaft. The pulley was then attached to the feed-lever hub with three 10-32 bolts.

If your drill press has no hub of this sort, you can machine a collar to take its place. The collar can be locked on the pinion shaft with two setscrews bearing against a flat.

Attach the cable to the pulley at a point that permits the cable to be wrapped once around the belt groove. If you use a speedometer cable, it may have a button on the end. In that case, simply drill a hole through the side of the pulley and thread it for a 6-32 screw. This holds the button.

The idler pulley may be any kind that

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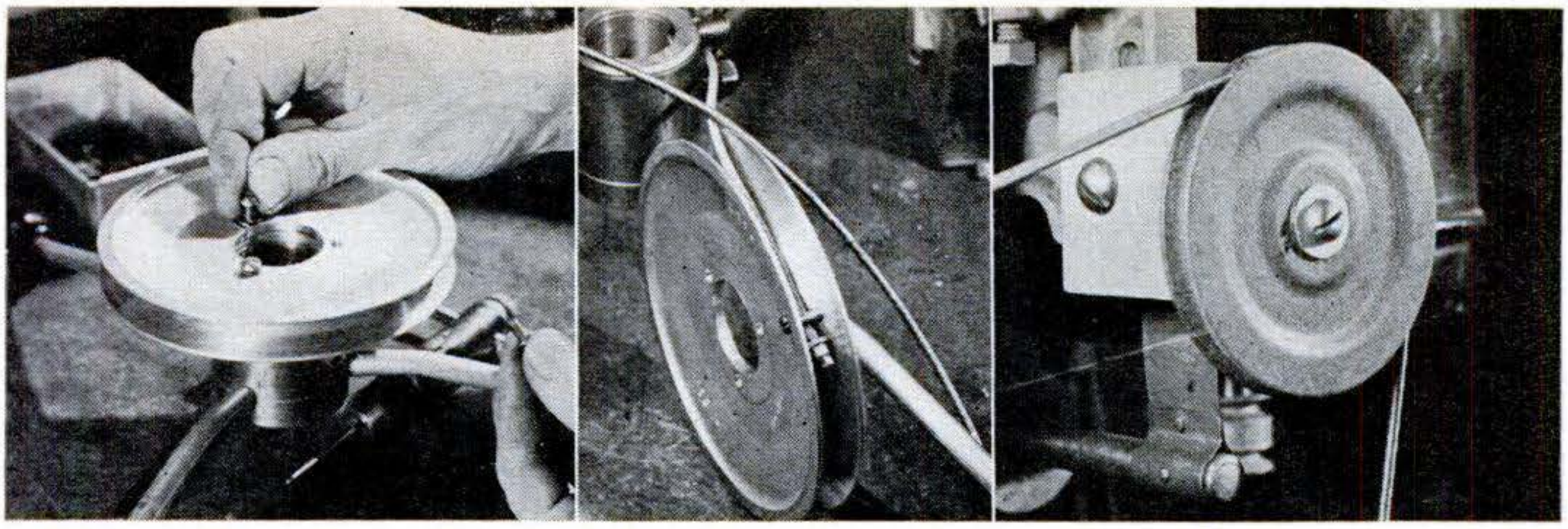


A V-belt pulley is fastened to the hub of the feed-lever assembly with 10-32 bolts. Original hub of pulley was removed. In the center, note how cable is attached to the pulley. A bolt through one side of the pulley retains cable button. Above is a closeup of idler pulley.

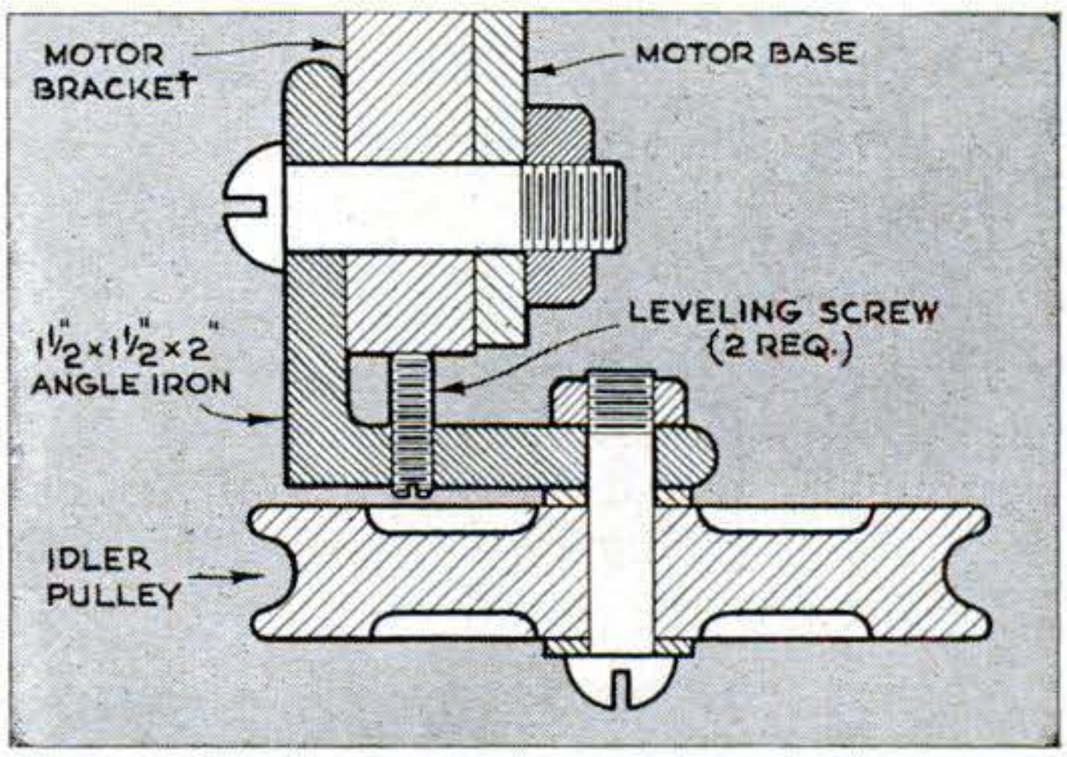
turns freely. The one shown has a 3″ diameter and a ball-bearing hub. You can attach the hub to a mounting bracket held by one of the drill-press motor bolts.

To prevent the bracket from twisting downward under the pull of the cable, two 8-32 leveling screws were installed. These bear against the edge of the motor bracket.

A stiff bar of steel about 24″ long serves as the pedal. It's supported by an angle-iron strip clamped to the drill-press column just above the base with a U-shaped piece of bar steel and two 5/16″ bolts. Fasten an automobile accelerator pedal to the bar.

Clamp the lower end of the cable between two flat steel plates. The longer plate is pivoted to the pedal bar by a ¼″ bolt. In the shorter one, file a groove for the cable.

It's probable that the full amount of the drill-press spindle travel can't be utilized by the foot-feed system without making the pedal travel excessively long. However, nearly all normal drilling requires only a fraction of the total spindle range.



This section shows how idler pulley is mounted on a bracket. Leveling screws true up pulley.

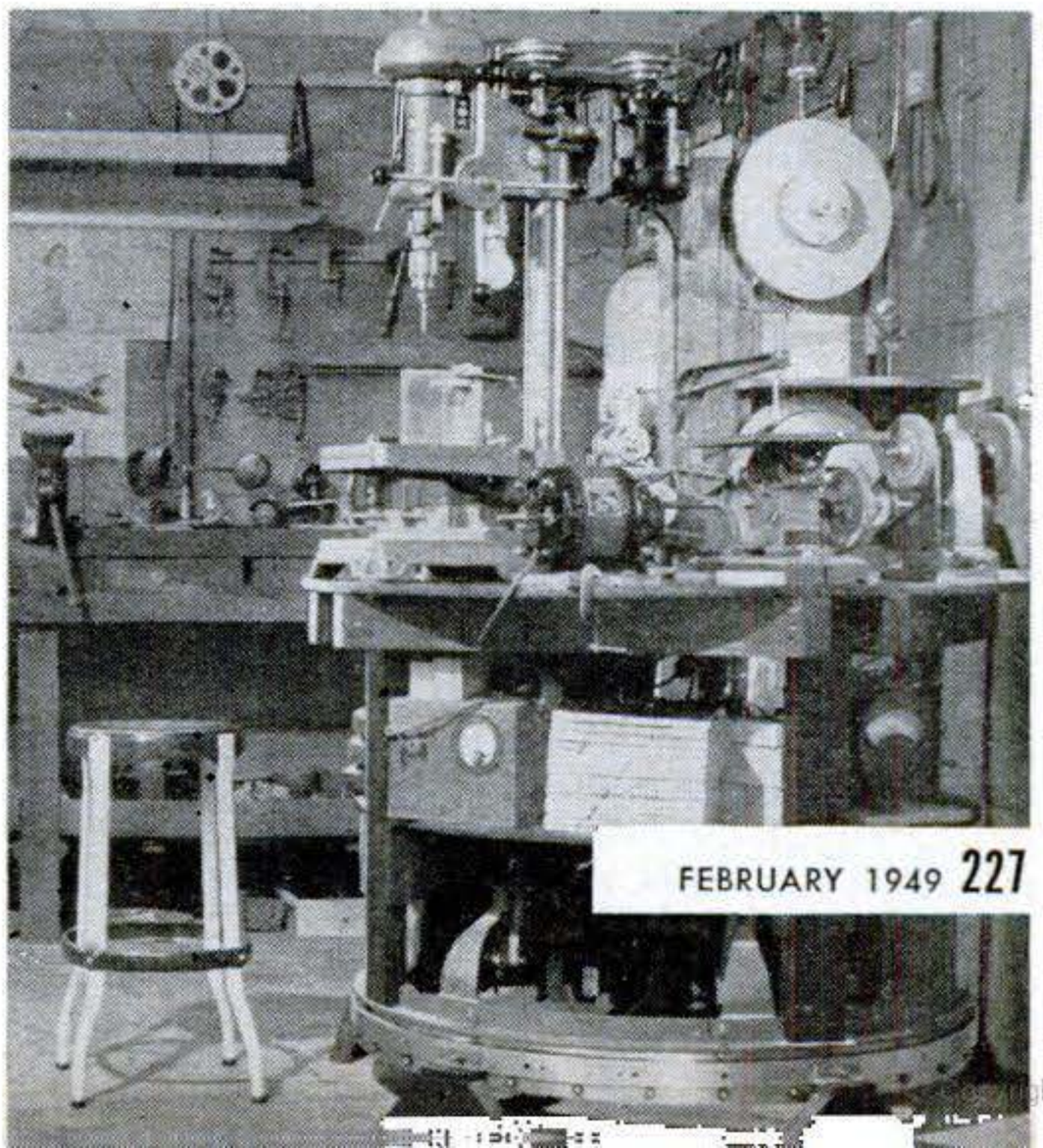
You may find that the combined weight of the pedal and cable, plus the added friction, is sufficient to prevent the spindle from returning to its topmost position. Increasing the tension of the spindle-return spring may overcome this. If it doesn't, you can add a screen-door spring or something similar to lift the pedal when pressure is removed.

Gun Turret Used as Lazy Susan for Power Tools

When Jet Stenen, of Van Nuys, Calif., bought a surplus gun turret from a salvage company, he had every intention of using it for a telescope mount. However, he never seemed to get enough cash ahead for the telescope he wanted.

Casting around for another way of using the turret, he hit upon the idea shown in this photo. After building a round table over the turret, he mounted his power tools around the edge.

"Now," he writes, "I can sit in one place and use the drill press, jigsaw, grinder, bandsaw, and other tools without moving."



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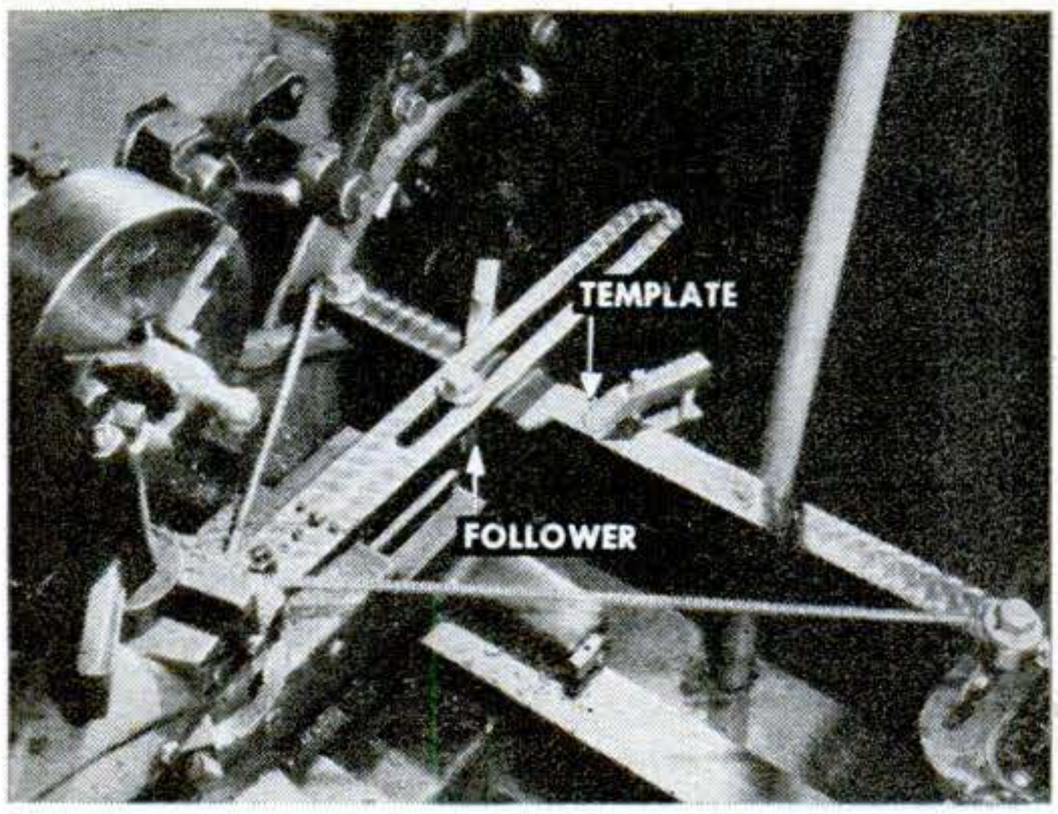
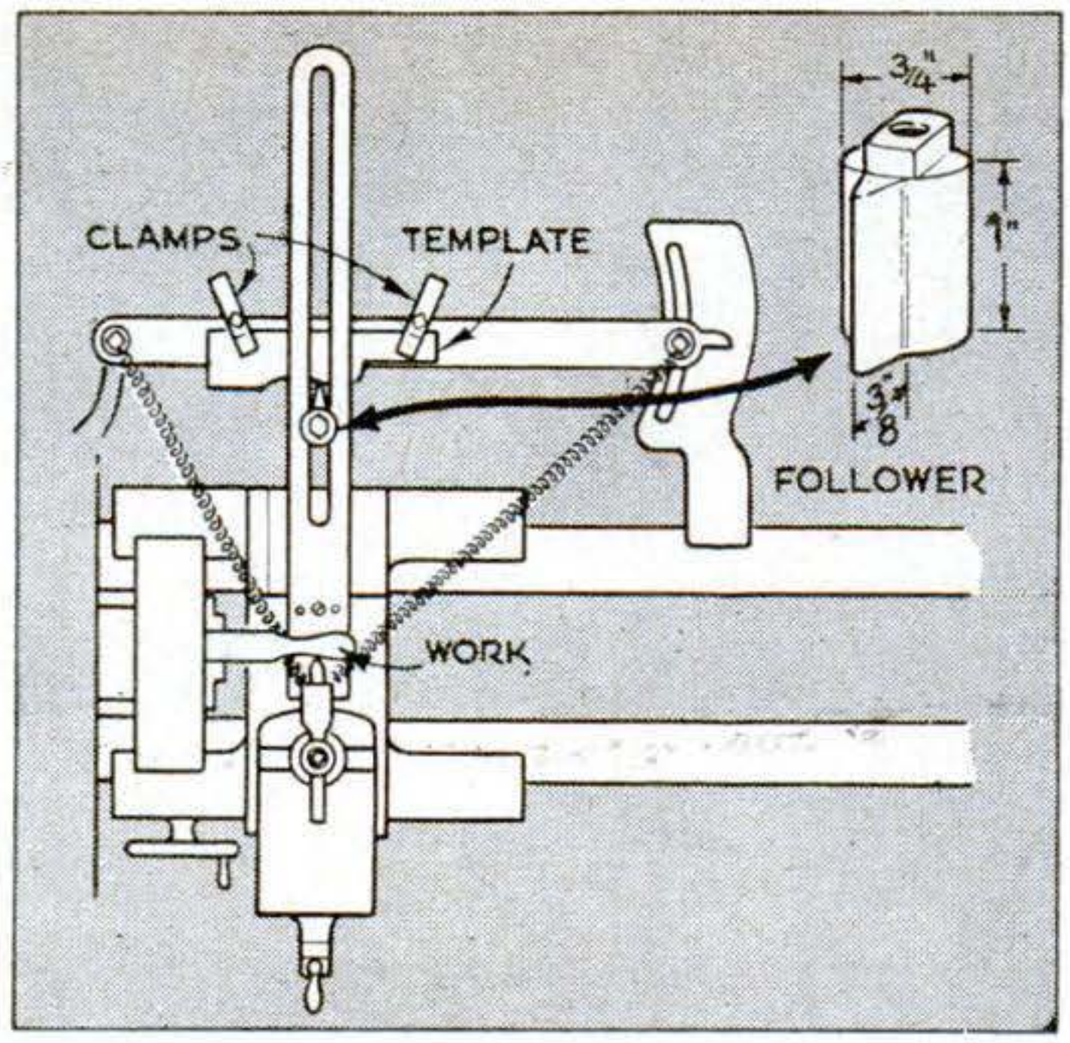
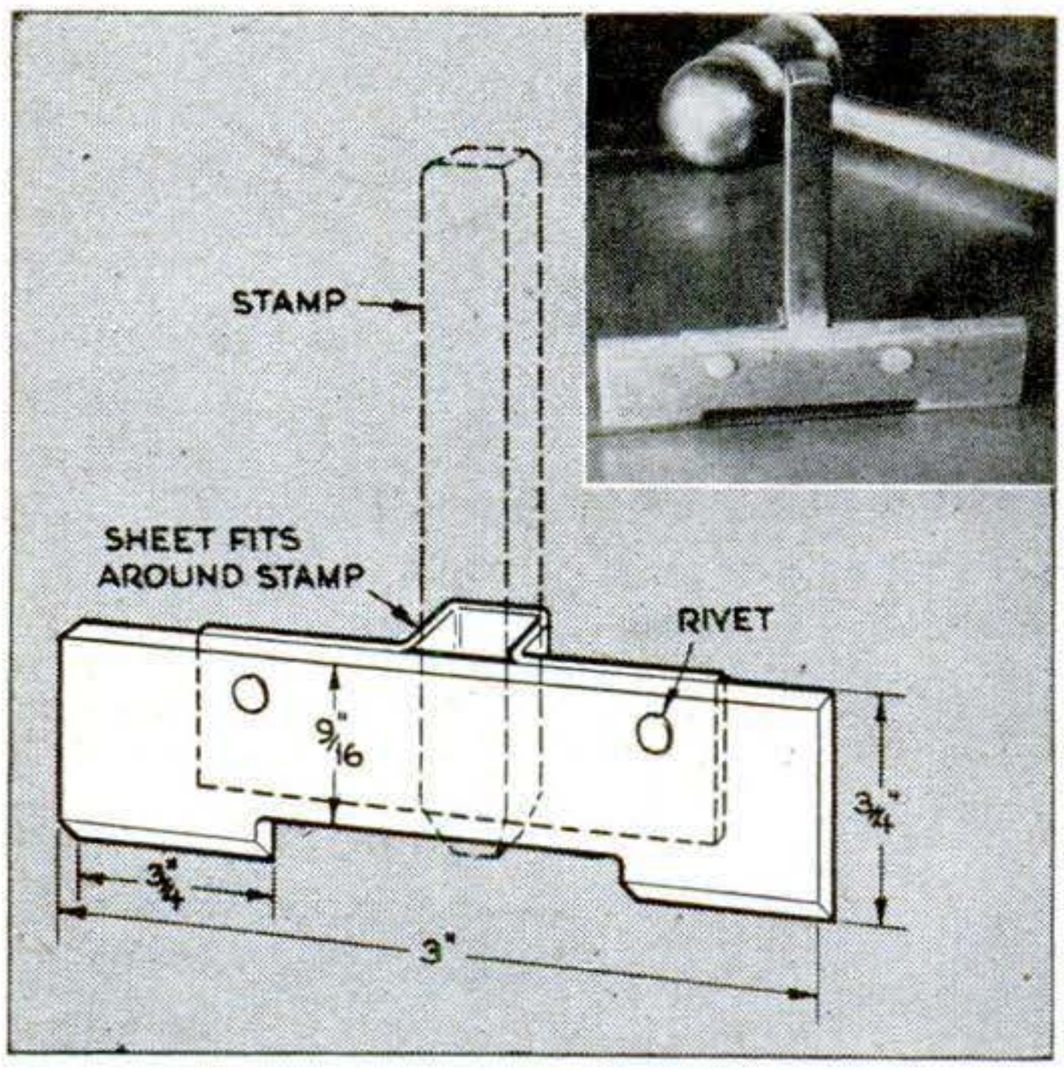




Turning Duplicate Parts. With this setup, it's easy to duplicate simple turned parts with reasonable accuracy.

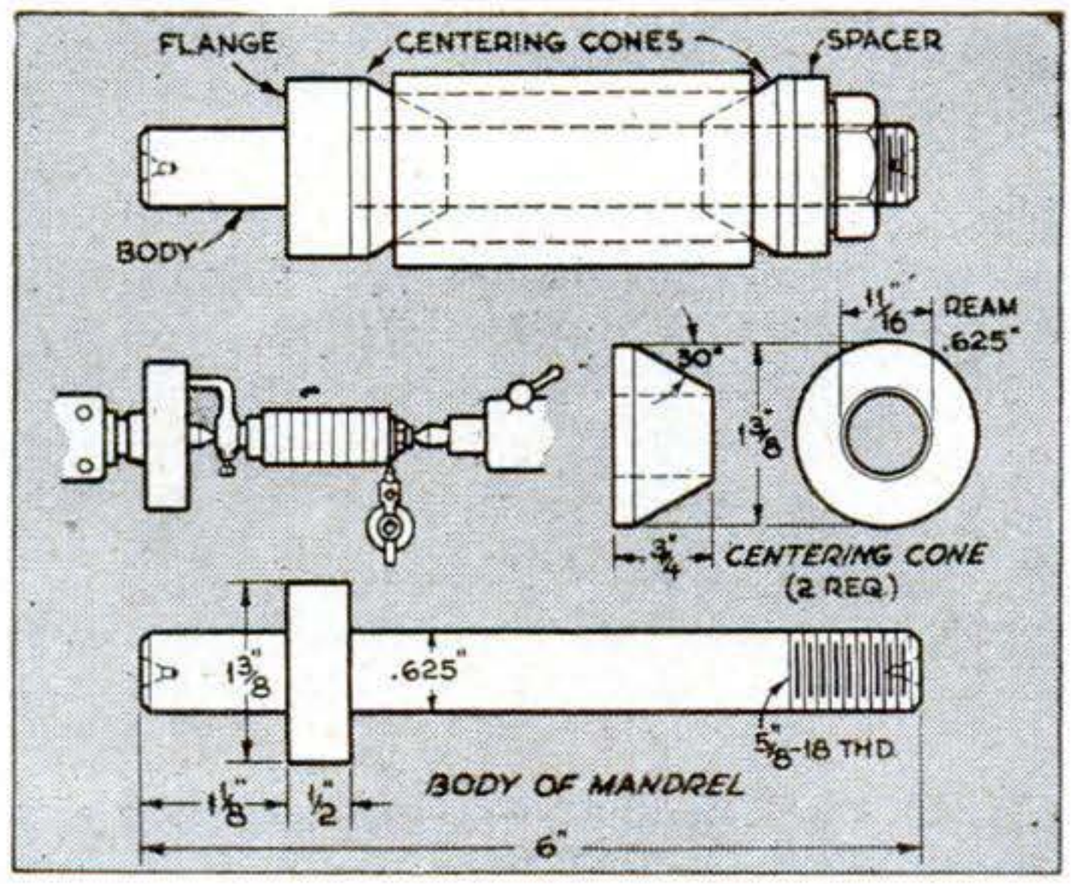
For the lathe shown, put the taper attachment in place in the usual manner but remove the guide-bar slide. Clamp the template for the part to be turned to the guide bar, with the template axis parallel to the ways. Make the follower of mild steel, carefully rounding and smoothing its pointed nose. It's held in the drawbar slot by a washer and cap screw.

Tension on the long spring should just make the lathe tool take a light cut. Heavier cuts can be made with hand pressure on the cross slide.—*Will Thomas, Kenmore, N. Y.*



Guide Keeps Stamp on Line. When a series of numbers or letters are to be stamped into metal, they can be neatly lined up with the simple guide shown here.

It's quickly made of sheet metal. Dimensions shown are about right for the usual small stamp. Bend the back member around the stamp so the latter is snug but moves freely when struck. In use, keep the feet of the guide on a scribed line. Move it a measured distance for each letter.



Mandrel Centers on Bore. In any shop, there comes a time when you must turn down the outer diameter of a pipe, bushing, or collar so it will be concentric with an existing bore. Here's a self-centering mandrel that simplifies the job. The only requirement is that the ends of the work be faced square.

Turn the body between centers, using tool steel or perhaps a salvaged auto axle shaft. If you wish, the flange may be shrunk on before finish turning. Ream the mild-steel cones to a sliding fit and taper-turn them. Make one or more spacers.

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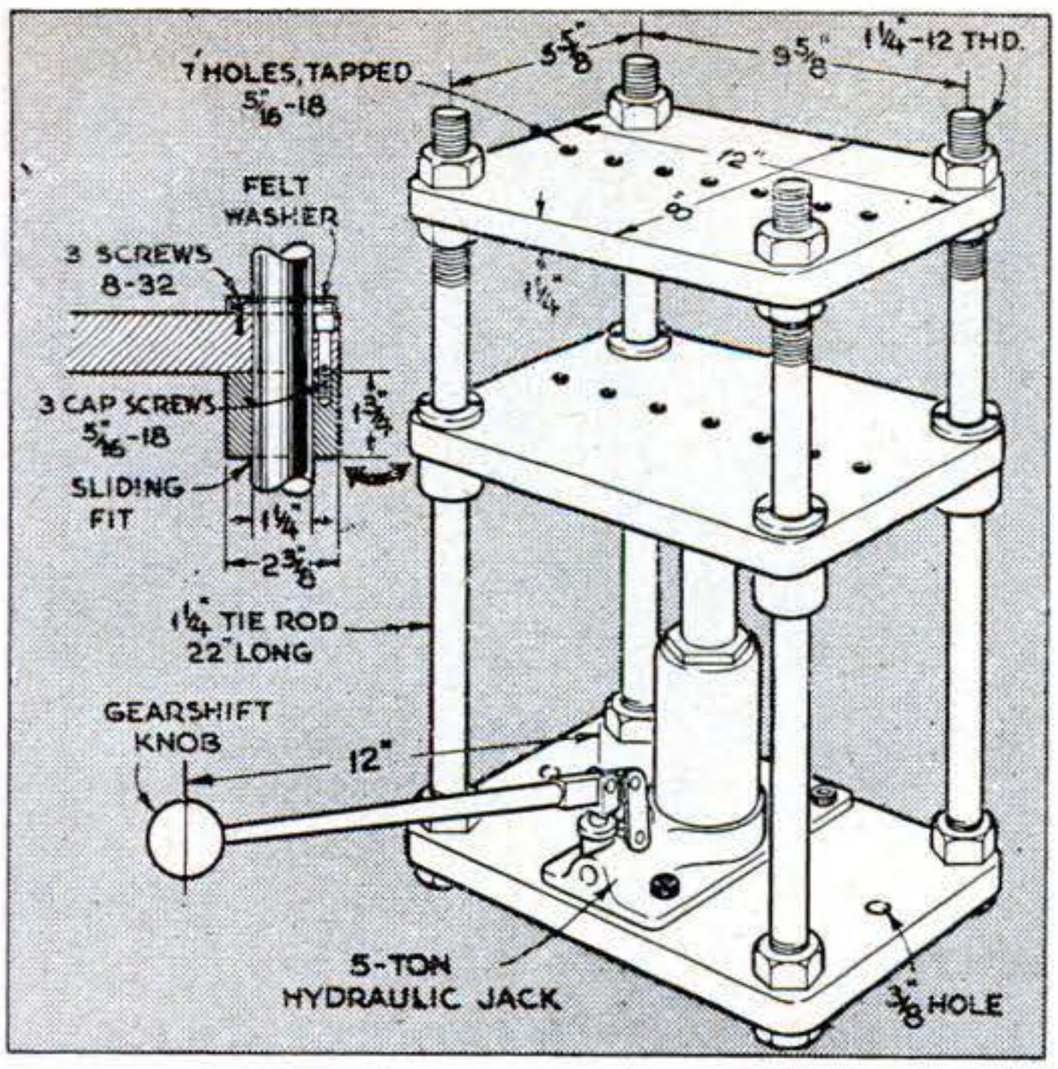
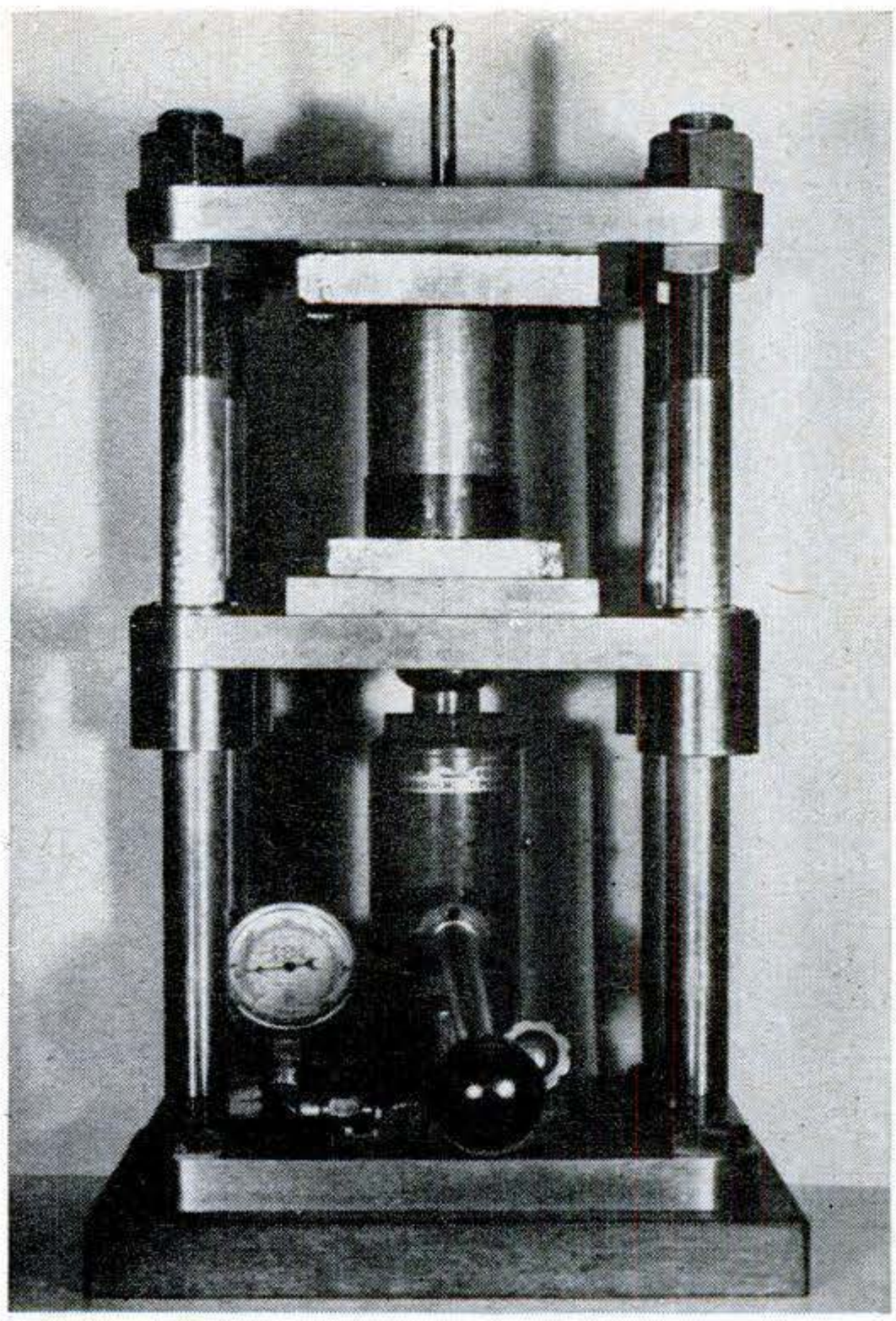


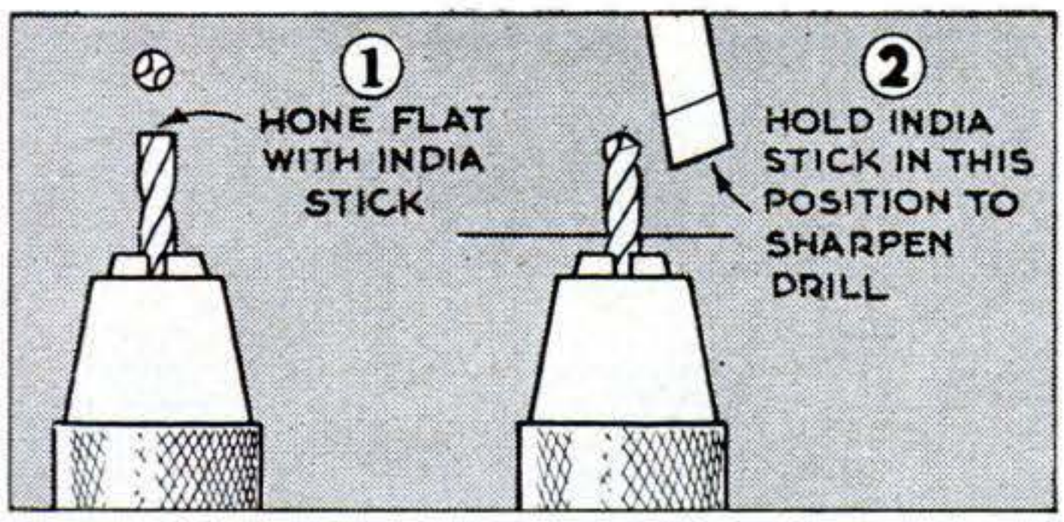


Press Does Hefty Jobs. Starting with a hydraulic jack of suitable dimensions, you can quickly make an arbor press like this one. With the possible exception of threading the supports, it doesn't require machine tools.

The press shown was made by John J. McGuckin, of Ridgewood, N. J. It was built around a jack rated at 5 tons. The press has been used for plastic molding, assembling parts that require forced fits, and for punching and drawing.

Cut the plates from cold-rolled steel and use cold-rolled rod for the supports. For a smart-looking job, use finished nuts if at all possible.

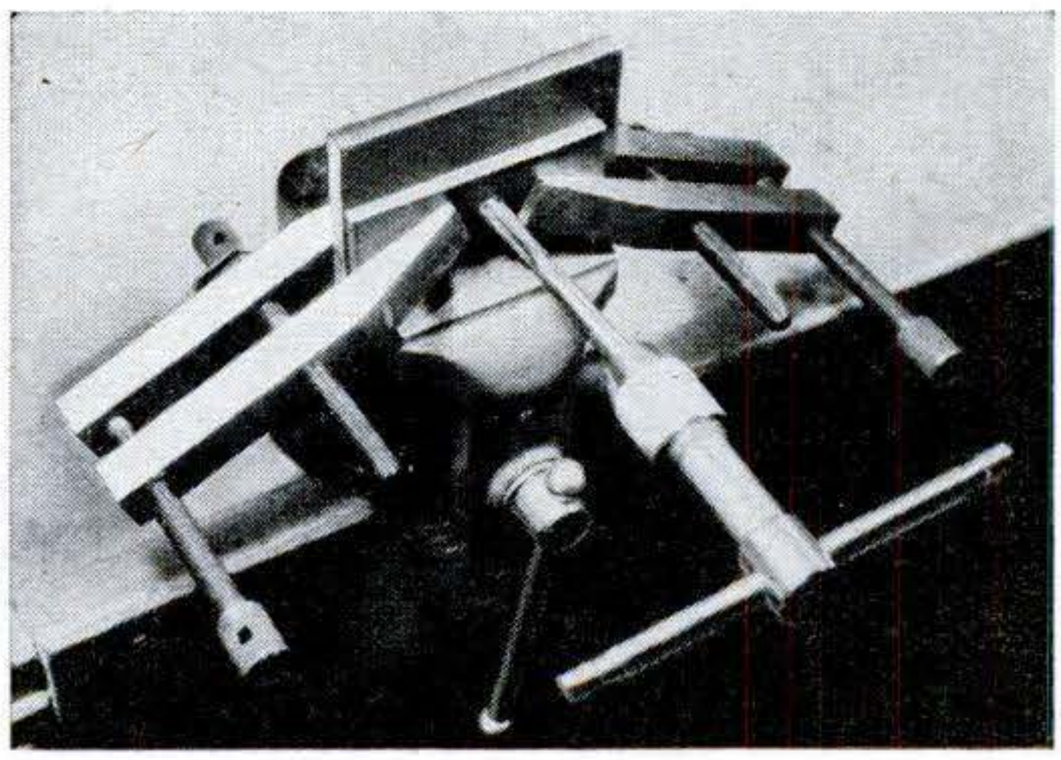
A pressure gauge is optional. The one shown, costing $2, reads to 4,000 lb. per sq. in.—*Joseph Tracy, Manhattan, N. Y.*



Sharpening Small Drills. Here's a way you can sharpen those small drills that are often thrown away. Clamp the drill in a pin vise, leaving about ¼" projecting. Then hone the end flat so the shape of the tiny flutes can be easily seen.

Now, holding the drill upright against the edge of the bench, rub the india stick firmly across it, tilting slightly to the left and rubbing slightly uphill.

Test by hand on scrap brass. If you get a hairlike chip, the drill's perfect. Otherwise, hone a bit more, increasing the tilt slightly.—*Herbert Pfister, Bronx, N. Y.*



Waste Piece Aids Tapping. Tapping blind holes in fairly thin pieces of metal is always something of a problem. A starting tap won't function and a bottoming tap won't start.

You can solve the problem this way: After drilling the blind hole, drill a similar hole *through* a piece of scrap. Clamp the pieces together with the holes aligned. Then do the tapping.

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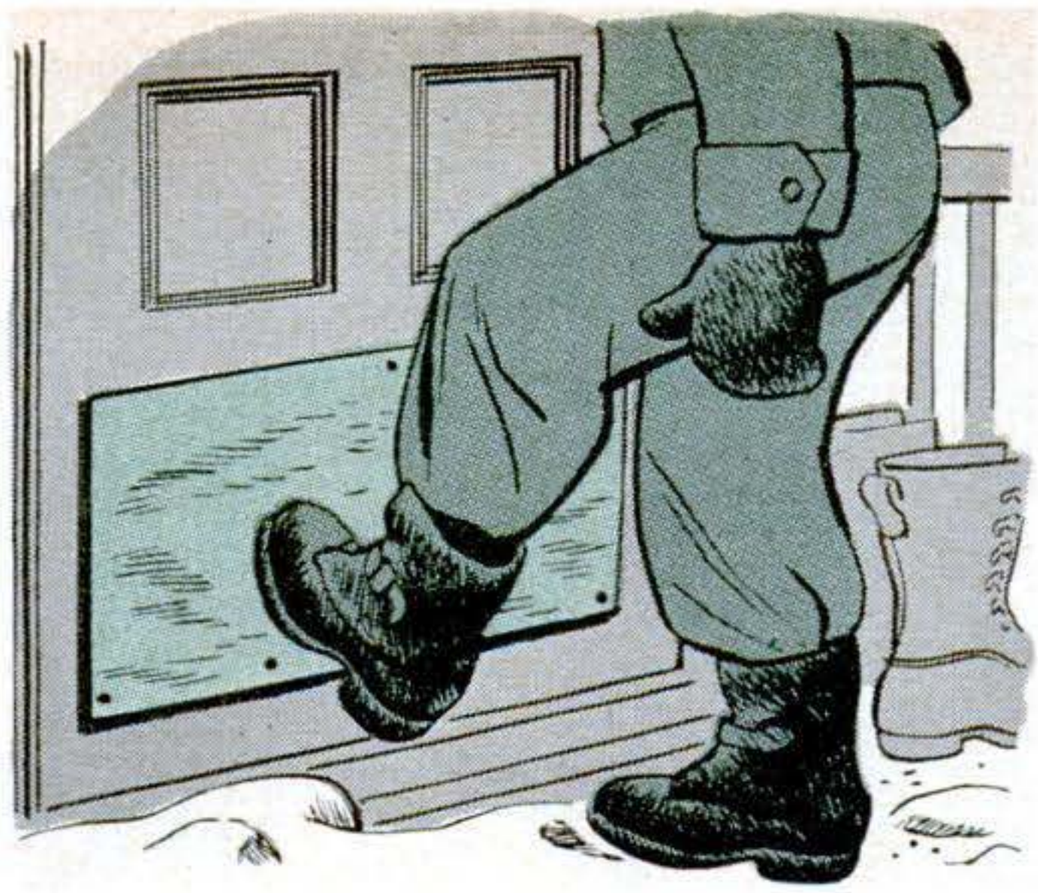
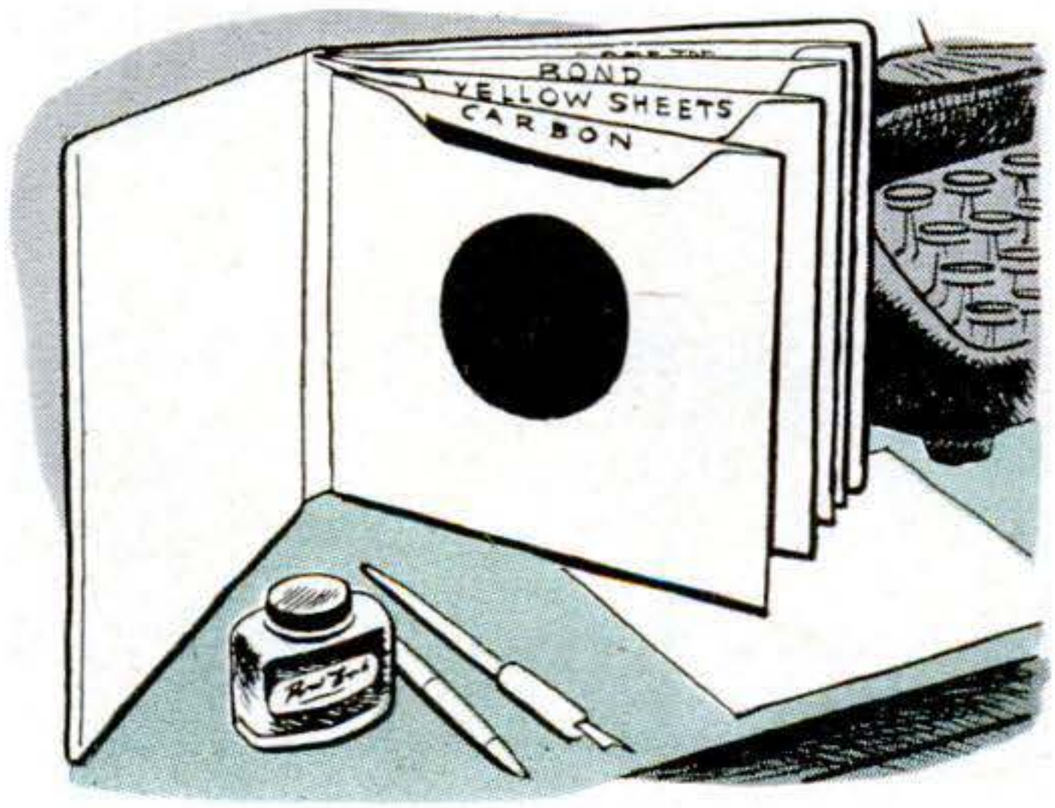
Keeping the Home Shipshape

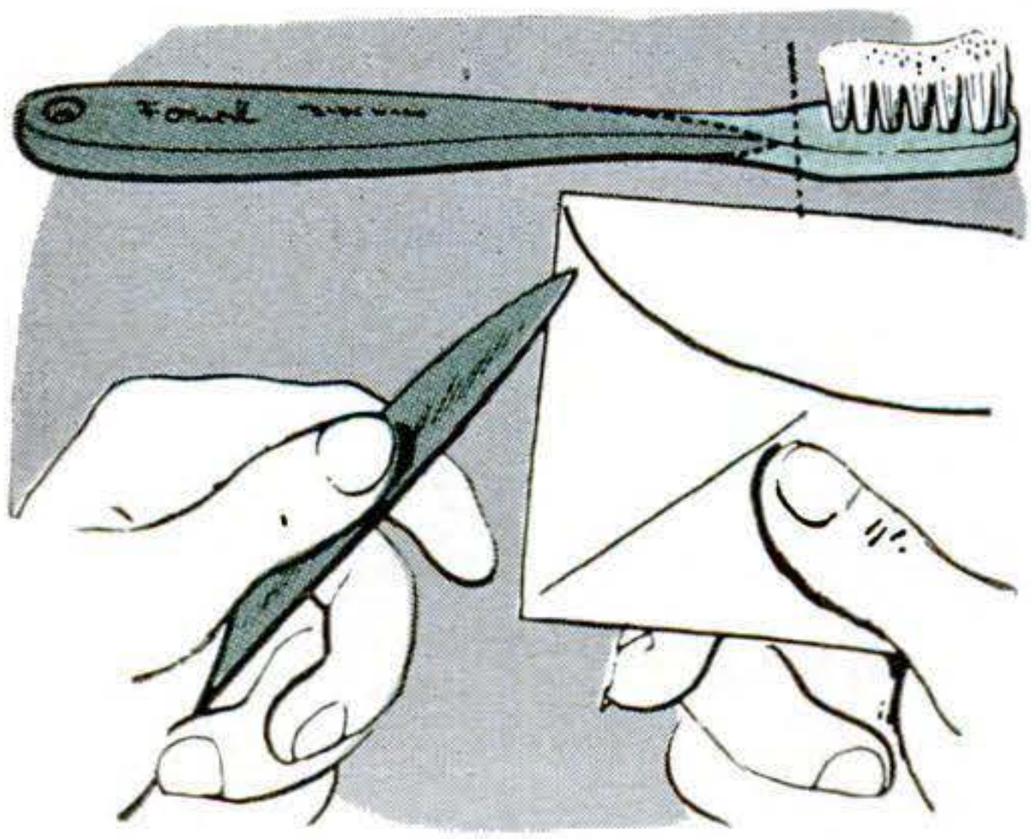
A tack tray made by nailing an empty shoe-polish tin to a block of wood makes a handy nonspill container on the job. Just put the polish-tin lid back on to store the tacks.



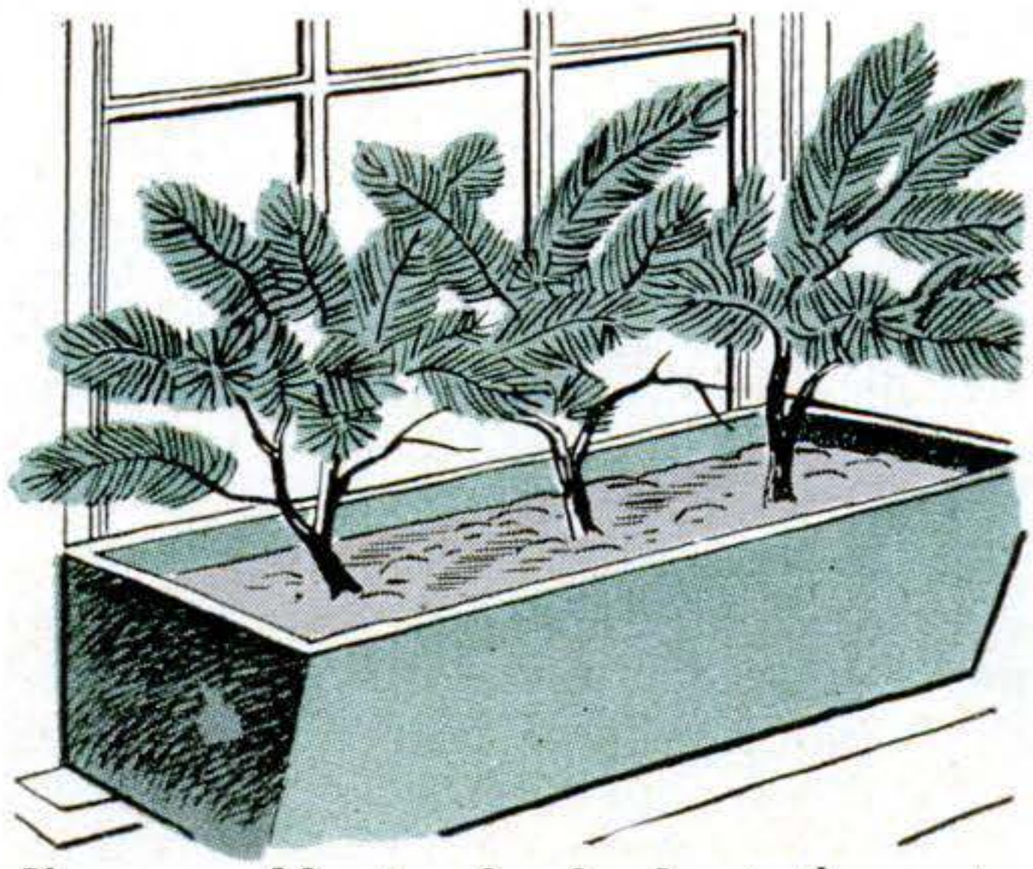
Nail a strip of left-over linoleum to the lower panel of the back door. It will absorb many of the scuffs and scrapes that youngsters usually plant by kicking doors open.



A 12" record album is a useful desk accessory. The pockets hold a supply of carbon, yellow, and bond paper as well as correspondence, clippings, work to be done, and the like.



Colorful letter openers can be made of discarded toothbrush handles. Grind off the lettering or other embossed material, and grind or file one end to a flat point.



You can add a touch of color to those window boxes that usually look so barren in the wintertime by sticking branches from evergreens or other cold-weather trees in the dirt.

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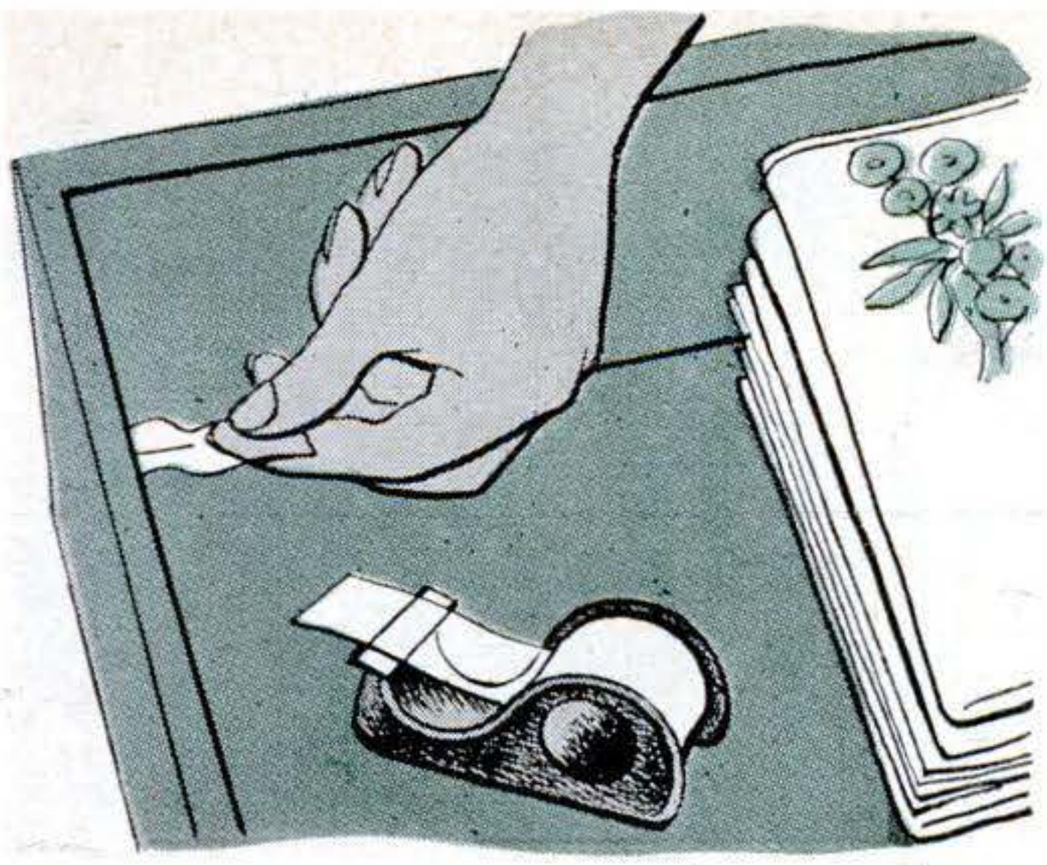
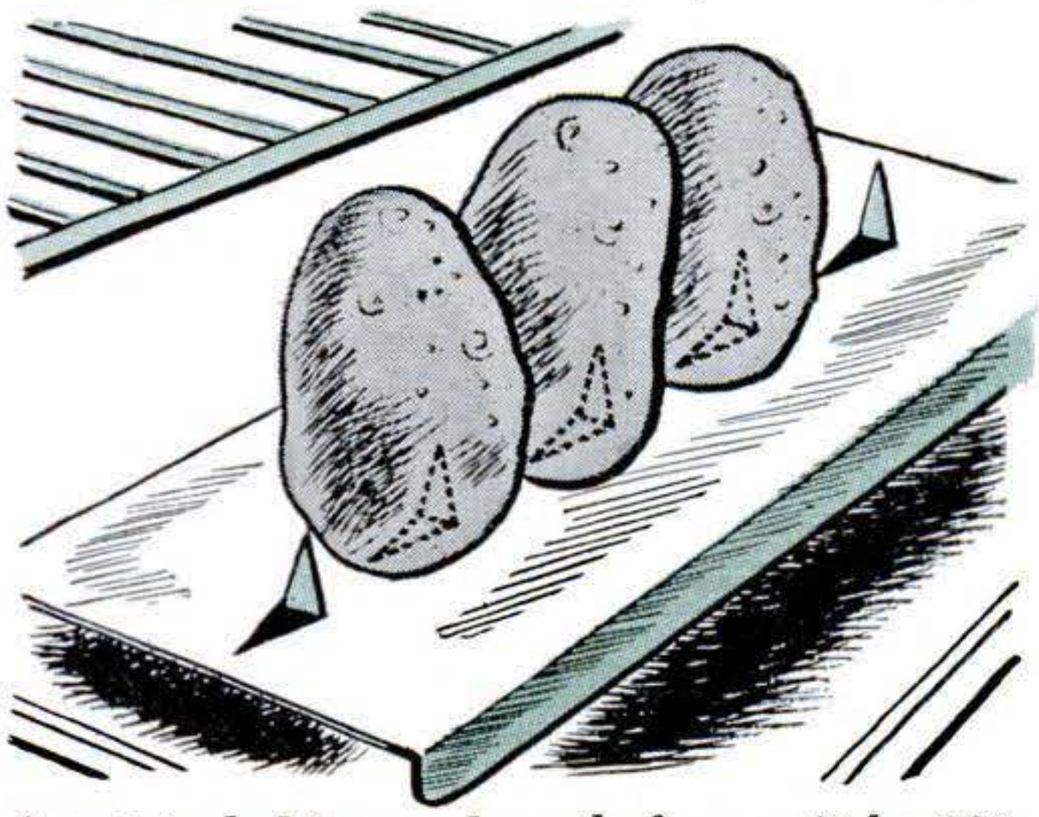


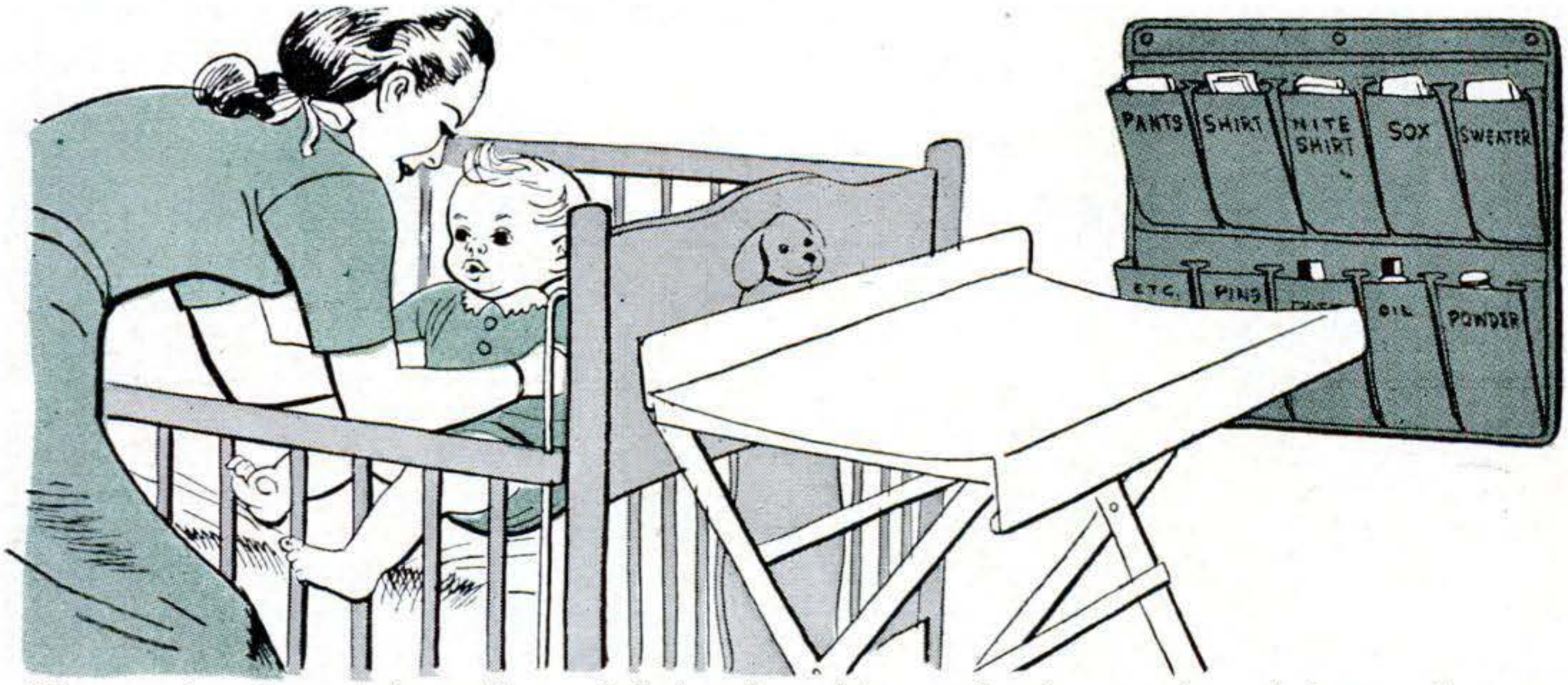
It isn't necessary to empty a drawer and turn it over to clean it. Simply brush the dust or dirt into a corner, press a strip of cellulose tape over the mound, and lift it out.

Prepare for one kind of mealtime emergency by keeping a supply of blotters in the drawer of the dining table. They're effective for sopping up spilled liquids in a hurry.



A potato-baking rack made from a 4" by 12" piece of aluminum or stainless steel will let potatoes bake more evenly. Chisel five V-shaped cuts and bend up tabs about ¾" long.

Yarn won't roll away as you use it if it unwinds from the center. Stretch the skein, hold a hank in the palm, and wind 20 loops on a finger. Roll up the rest around these loops.



Hang a shoe bag on the wall near baby's crib or on the foot of the crib itself to store oil, shirts, and other much-used items. A transparent plastic bag wouldn't require labeling.

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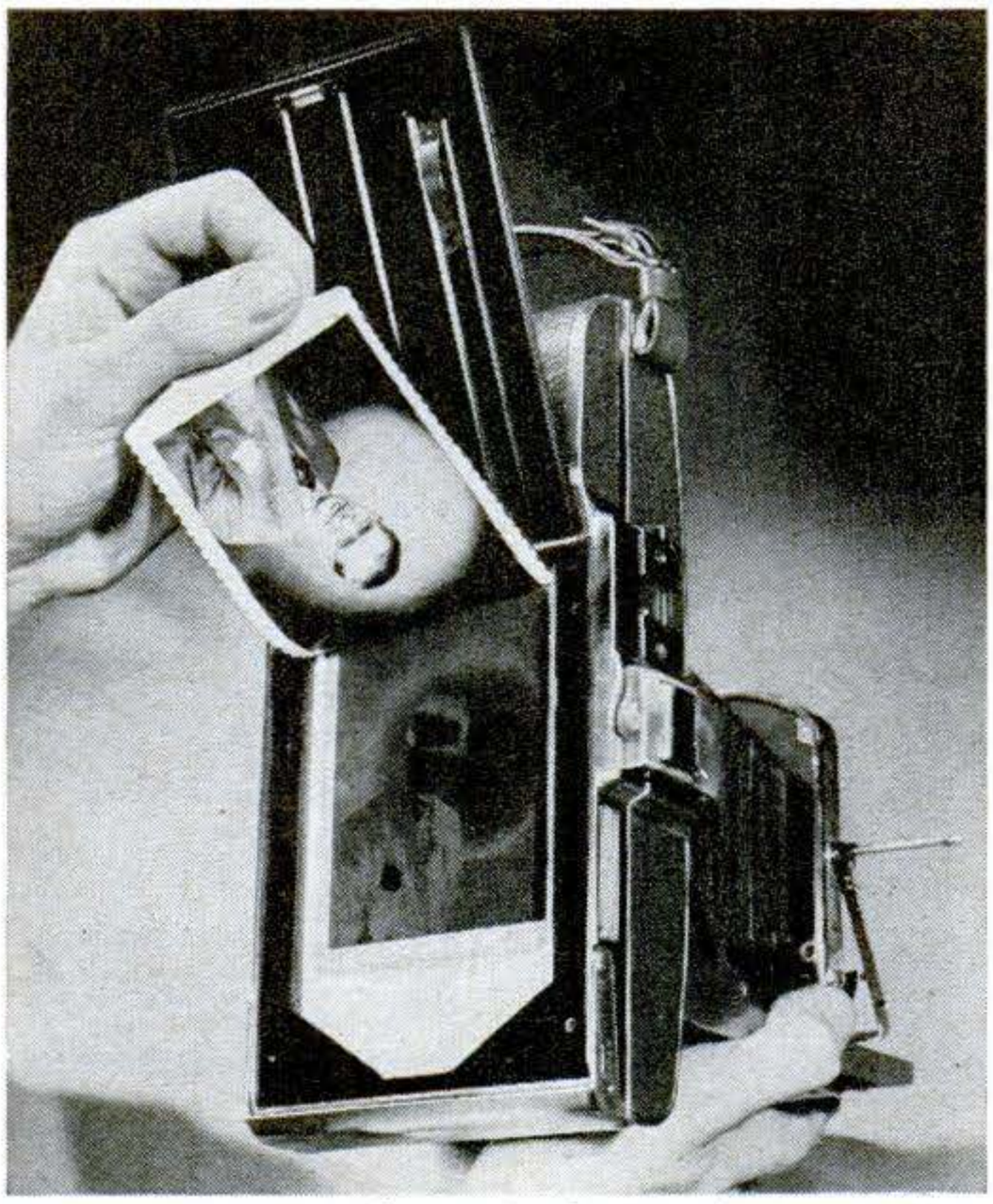
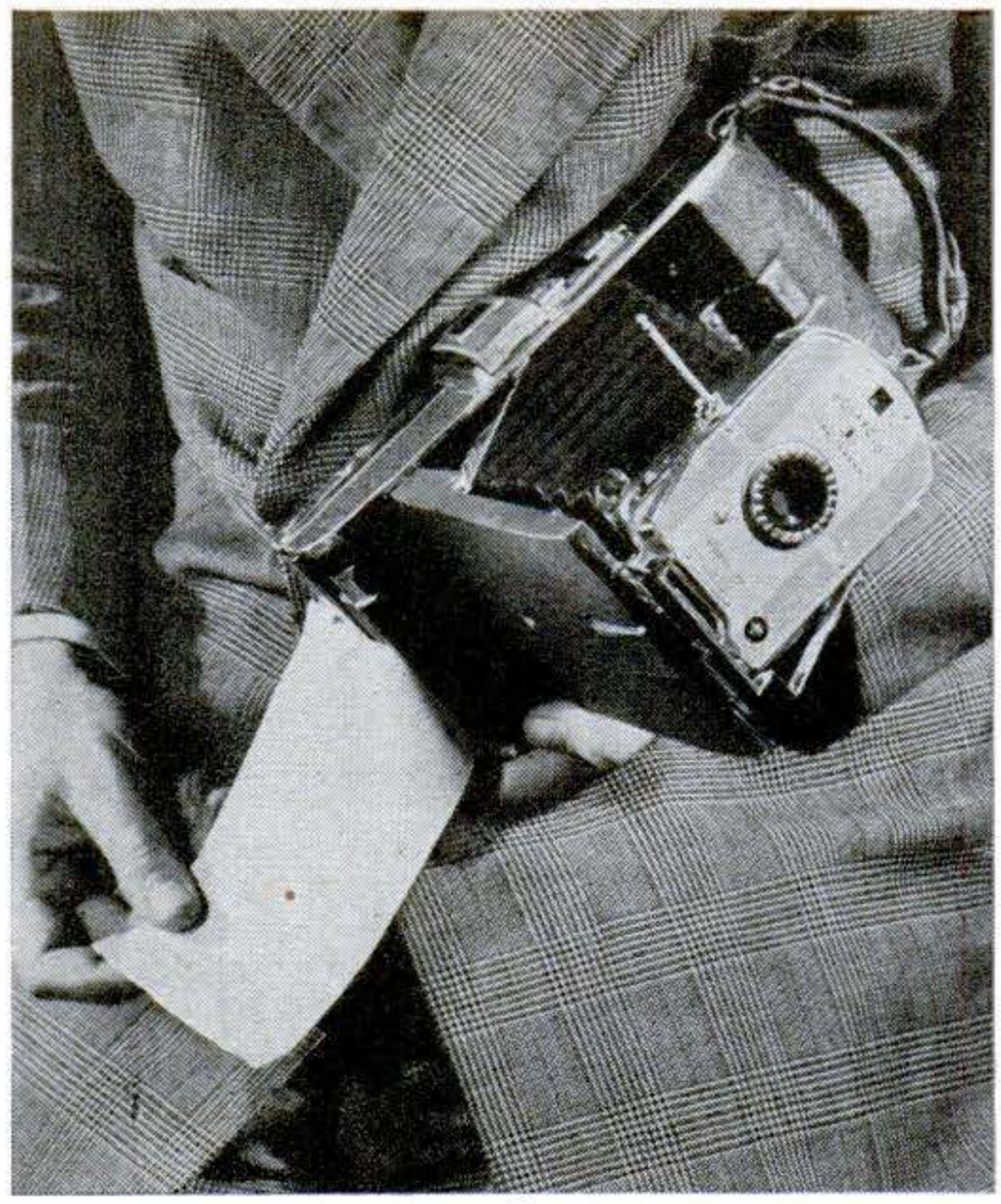
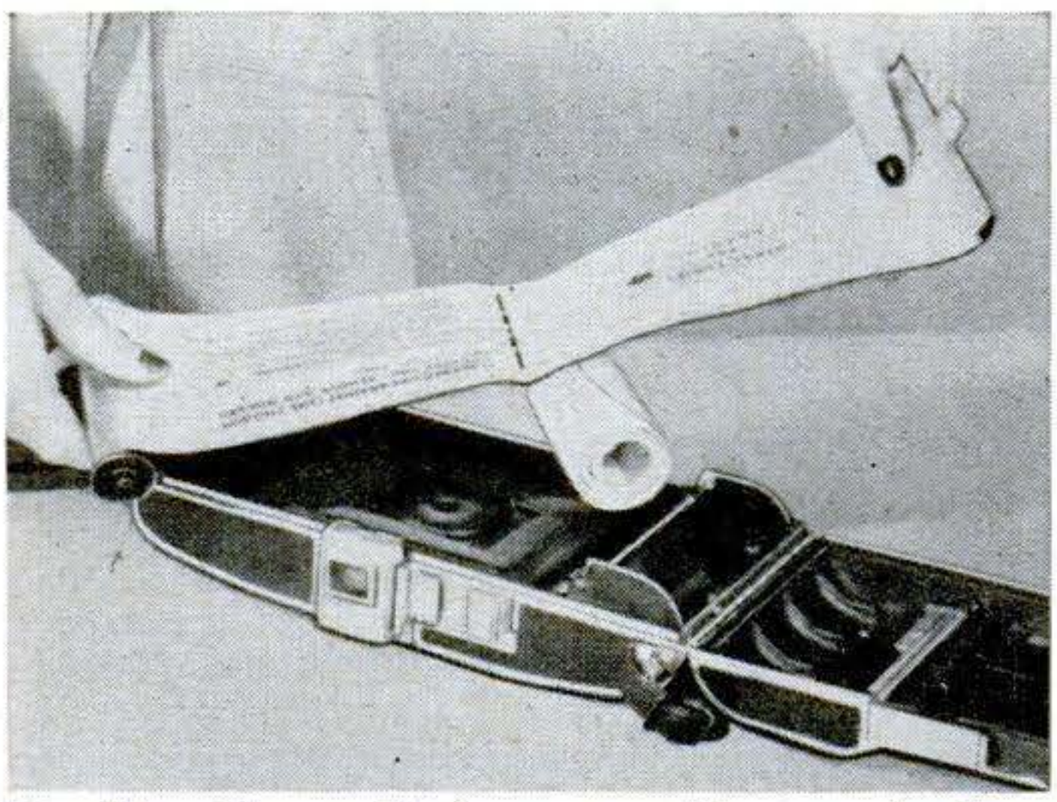


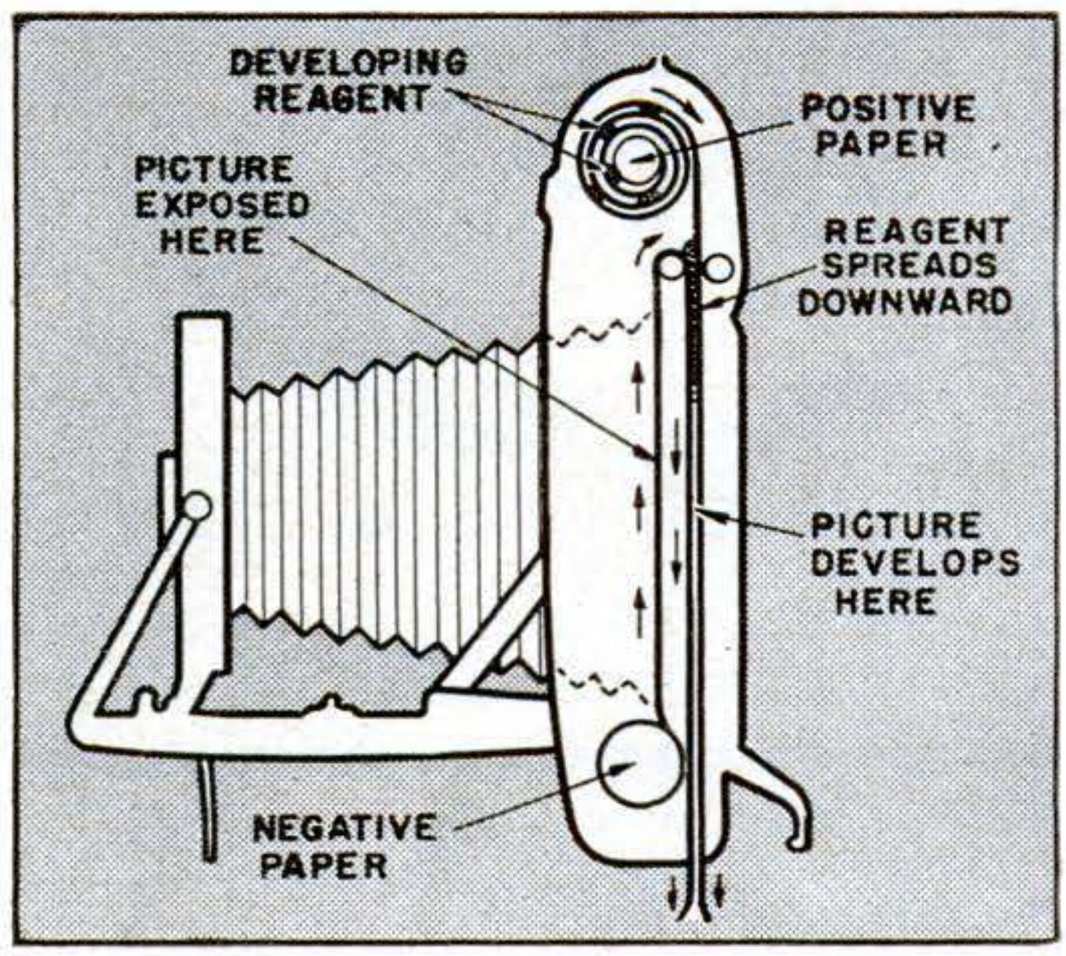
Photo is peeled from the back of special film. The print measures 3¼" by 4¼", has sepia tone, and is permanent. Negative is used only once.



Film is advanced by pulling the leader through slot. Turning a dial in top corner of lens board sets both shutter speed and lens opening.



Double film roll drops quickly into loading slots. Positive roll contains eight capsules of developing reagent, one for each print.



Camera Gives Print in a Minute

NOW you can snap a picture and see it only a minute later. The camera that does this is an entirely new type. It's the first production model of the Polaroid Land Camera (PS, May, '47, p. 150). It costs less than $100.

The camera uses a special film that gives you eight pictures. Each one costs just a little more than you'd pay for drug-store processing of ordinary prints of this size.

Contained in the roll of positive paper are eight tiny capsules of jellied reagent. When you advance the film after snapping a picture, a capsule is opened as it passes between two rollers. The jelly simultaneously develops the negative and forms a print. You pull out the print after a 60-second wait. For extra prints, you make another exposure or copy the original.

One control sets both shutter speed and lens opening. Numbers from 1 to 8 in an opening above the lens show whether the camera's set for bright sun or poor light conditions. The camera has flash contacts.

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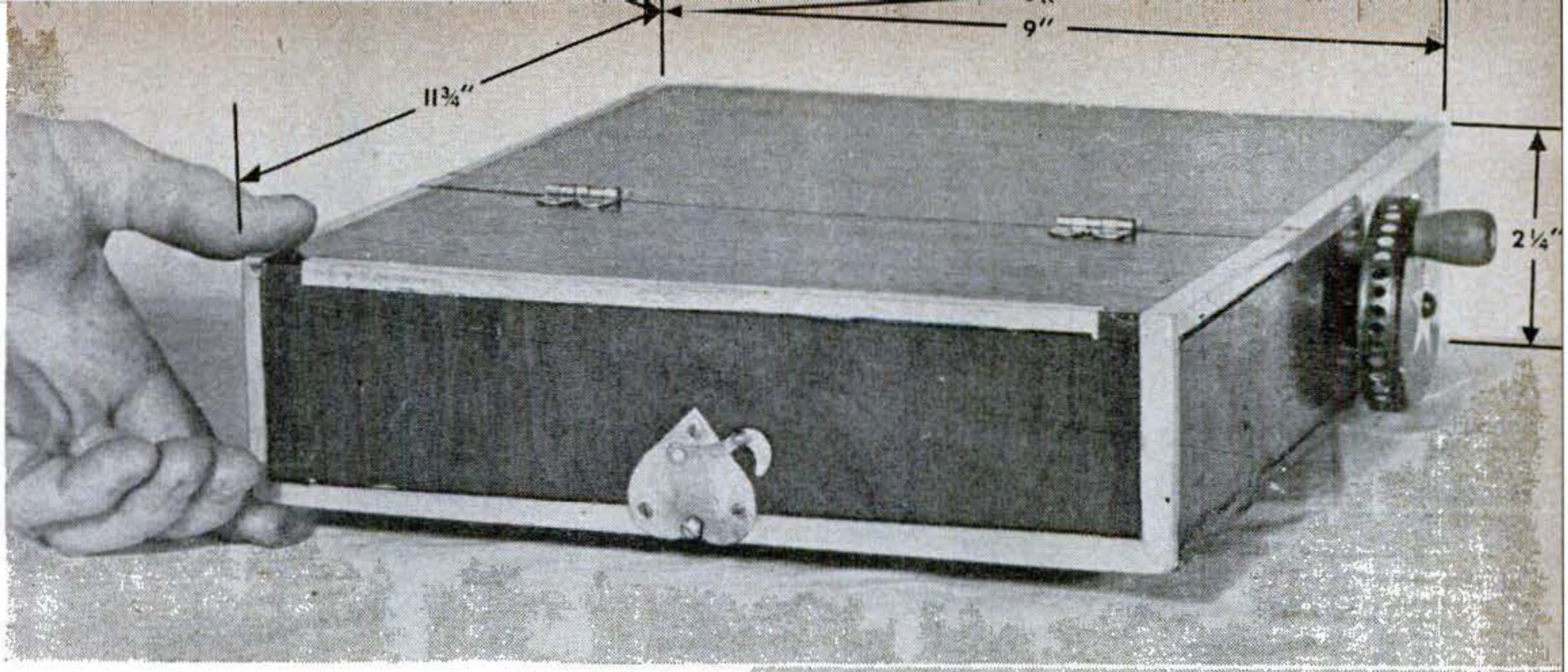


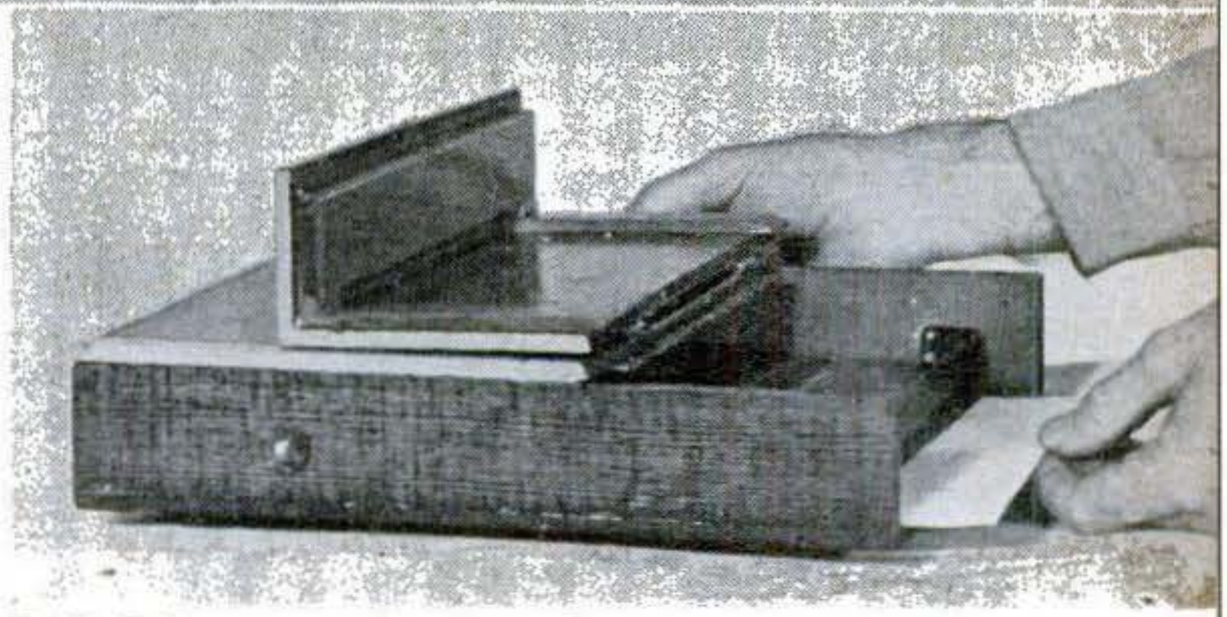
Darkroom Safe Delivers Paper at Turn of Knob

EACH time you turn the hand wheel, this darkroom safe dispenses a single sheet of enlarging paper. The dimensions shown suit the safe to 8" by 10" paper.

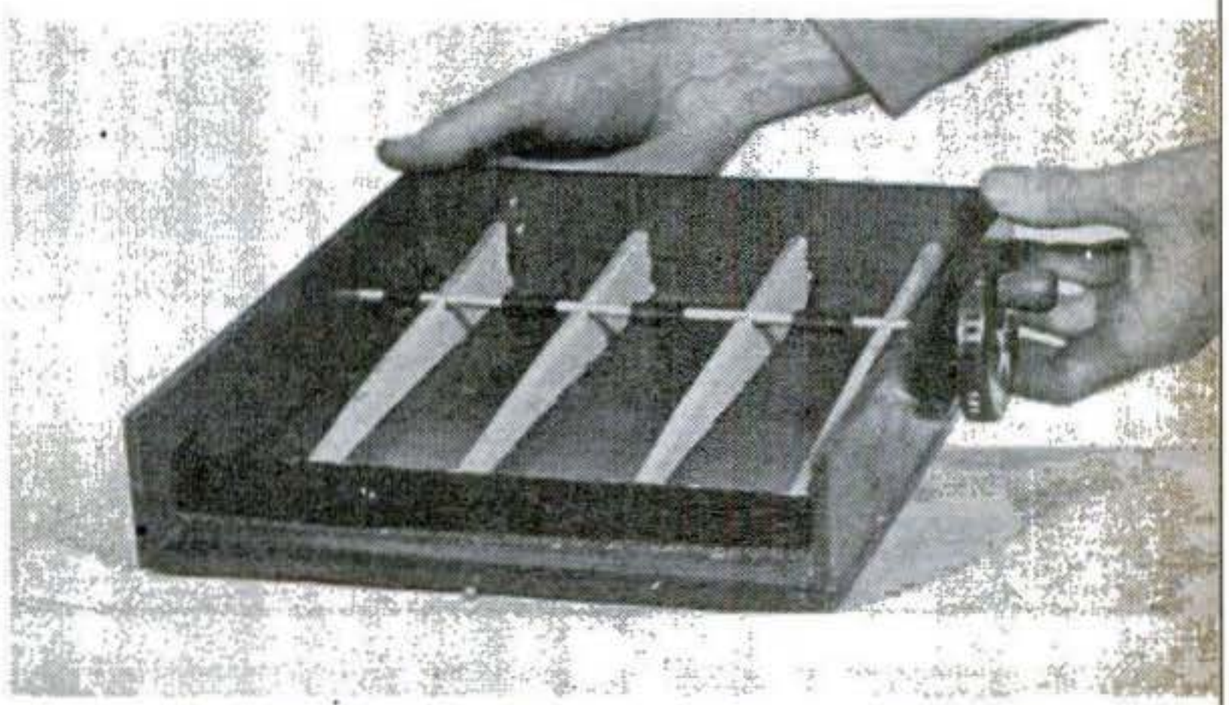
The box is quickly assembled from ¼" plywood or scrap stock. Thin strips spaced away from the inside edges of the hinged cover make an adequate light trap. Also glue a strip of cardboard under rear part of the cover to project over the hinge crack.

Tapered strips slanting from the rear serve as a false bottom. An aluminum shaft is inset flush with the top edge of these strips. At the front is a sheet-metal paper stop. Its bottom edge is raised just enough to allow one sheet of paper to pass under it.

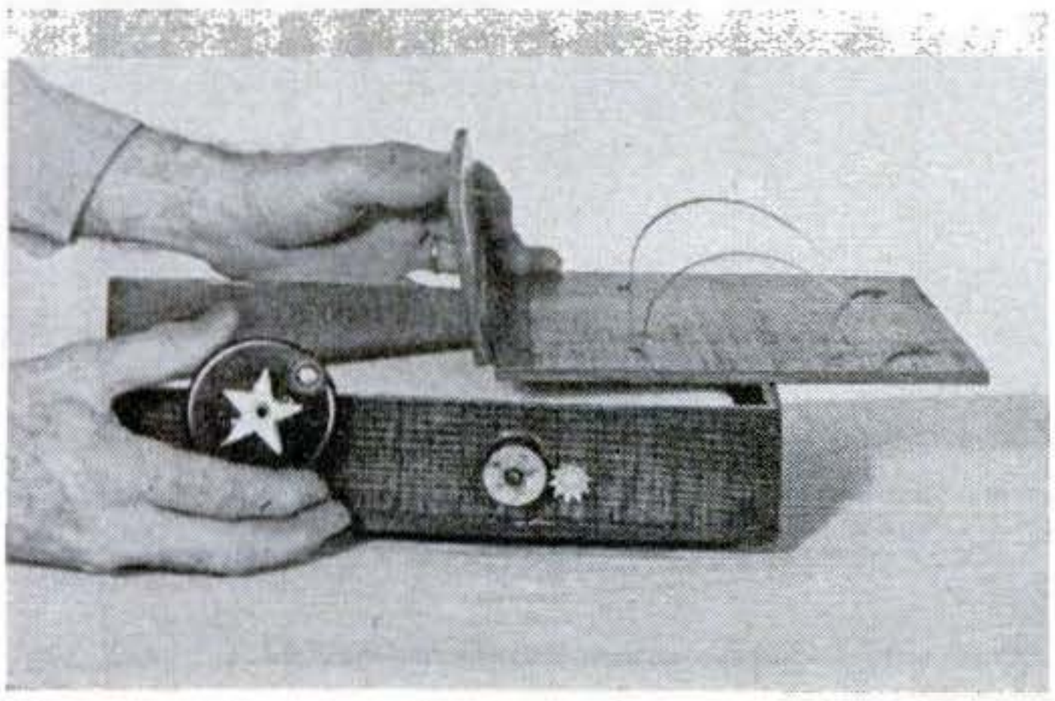
The hand wheel was made from a tin-can lid, 38 holes being drilled around its edge to mesh with a pinion filed from sheet iron.—*E. Peter Smith, Los Angeles.*



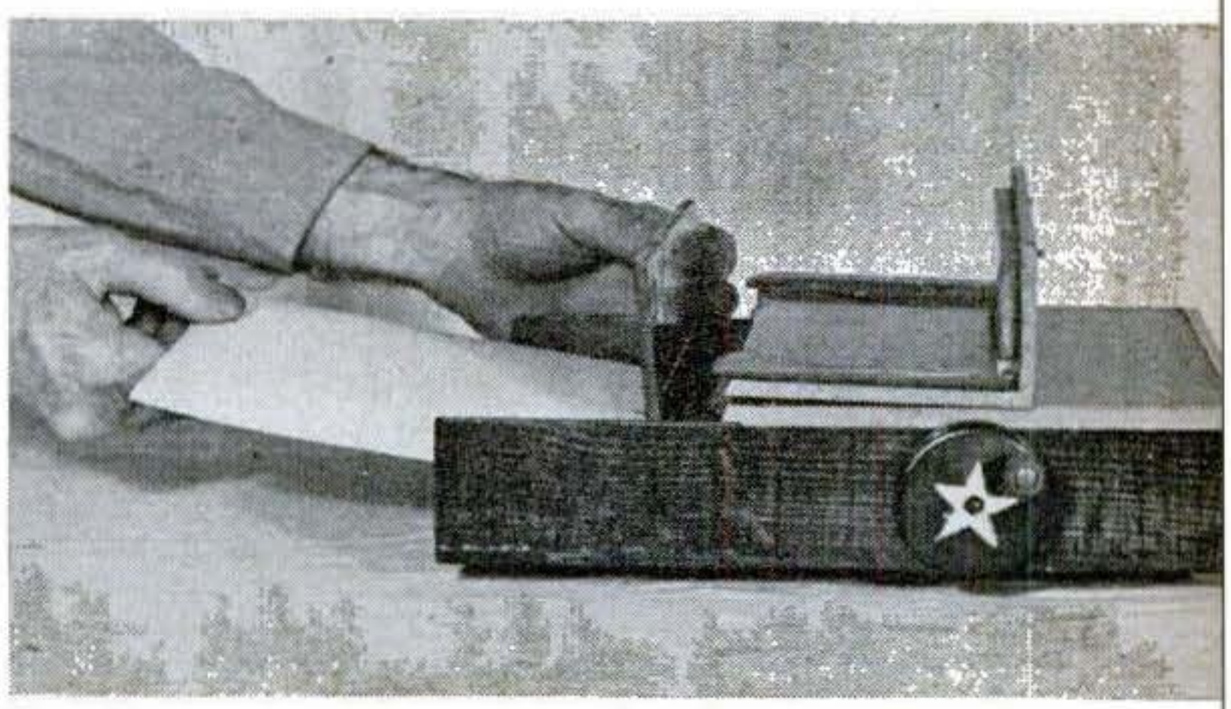
Lift lid, turn wheel, and out comes one sheet. Box holds enough for single enlarging session.



Eccentric windings of tape on the shaft push bottom sheet of paper down inclined risers.



Steel springs on floating platen inside safe exert downward pressure on the paper supply.



Load paper with sensitized side up. Hinging front part of platen permits quicker loading.

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Two types of spots that may show up on your photos are indicated by the arrows. Pinholes and scratches in a negative print black in the lighter areas. If you accidentally touch the negative with an oily thumb, you may produce a light area. Both types are easily repaired.

Retouching Saves Spotted Prints

By H. W. Moore

A FAMOUS photographic instructor once said that the easiest way to spot enlargements is to make perfect negatives in the first place. But like lots of theories, this one doesn't always work out in practice.

Skilled retouchers can work wonders on a negative. Getting this skill takes a lot of time and practice. Until you've become reasonably proficient, more likely than not any handwork on a negative will become embarrassingly evident on enlargements.

Repairs to a paper print, however, are comparatively easy to make. By a little cautious work, you can get satisfactory results on the very first try. So let's take a look at an average print and figure out the practical ways to eliminate its defects.

In a print, there are actually only two types of defects to be overcome. Either you must lighten spots that are darker than the area immediately surrounding them—or you must darken spots that are too light.

If you have a light touch and unlimited patience, you can scrape away at a dark spot with a retouching knife until it almost matches the surrounding area. This works, but it's not the easy way by any means.

All too often you'll end up with a hole in the paper. Perhaps, you've had this happen—and wondered why. Your first scrape was light, tentative, and you saw no results. The next may have been a little harder, with still no visible effect. So you tried again, this time with a lot more pressure—and the knife went right through.

The reason for your disappointment is that the emulsion of many photographic papers has a protective coating of colorless gelatin. Your first few knife scrapes were taking away this coating, but you couldn't see your progress. By the time the knife got down to the emulsion, the pressure behind it was so great that it went much too far.

But why try to scrape away dark spots? There are two very simple and practical alternatives. You'll get good results with either.

One of these calls for the use of two readily available solutions—iodine and hypo. Just pick up a drop of iodine on a toothpick

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and deposit it on the offending spot. After a few seconds, daub the iodine with a small roll of cotton soaked with the hypo. Bleaching takes place almost immediately, leaving a light area in place of the dark spot.

The second method is even simpler. Use a little Clorox ®, or any similar household bleach that contains sodium hypochlorite. Put a drop on the end of a toothpick and cover the black spot. When the solution begins to fizz, soak it up with a piece of clean, dry cotton or a white blotter.

If carried to completion, this process also leaves a white spot. It's possible to control the tone by limiting the time the solution is allowed to remain on the print. However, this timing isn't critical, for if the dark area is bleached too much it's simple enough to darken it again to the desired tone.

In fact, this is the secret of practical print retouching. All black spots are removed by chemical means. Then you fill in the resulting—and all other—white spots with a pencil, sable brush, or spotting colors.

Retouching pencils are supplied in several degrees of hardness. For a starter, get one of HB grade. Sharpen it as shown in the photos at the lower right.

There are two reasons for using this long, delicate point. It allows you to spot even the smallest areas without overlapping into the background. It also helps you develop the proper pencil pressure. Your touch should be just firm enough to deposit the lead on the surface of the print.

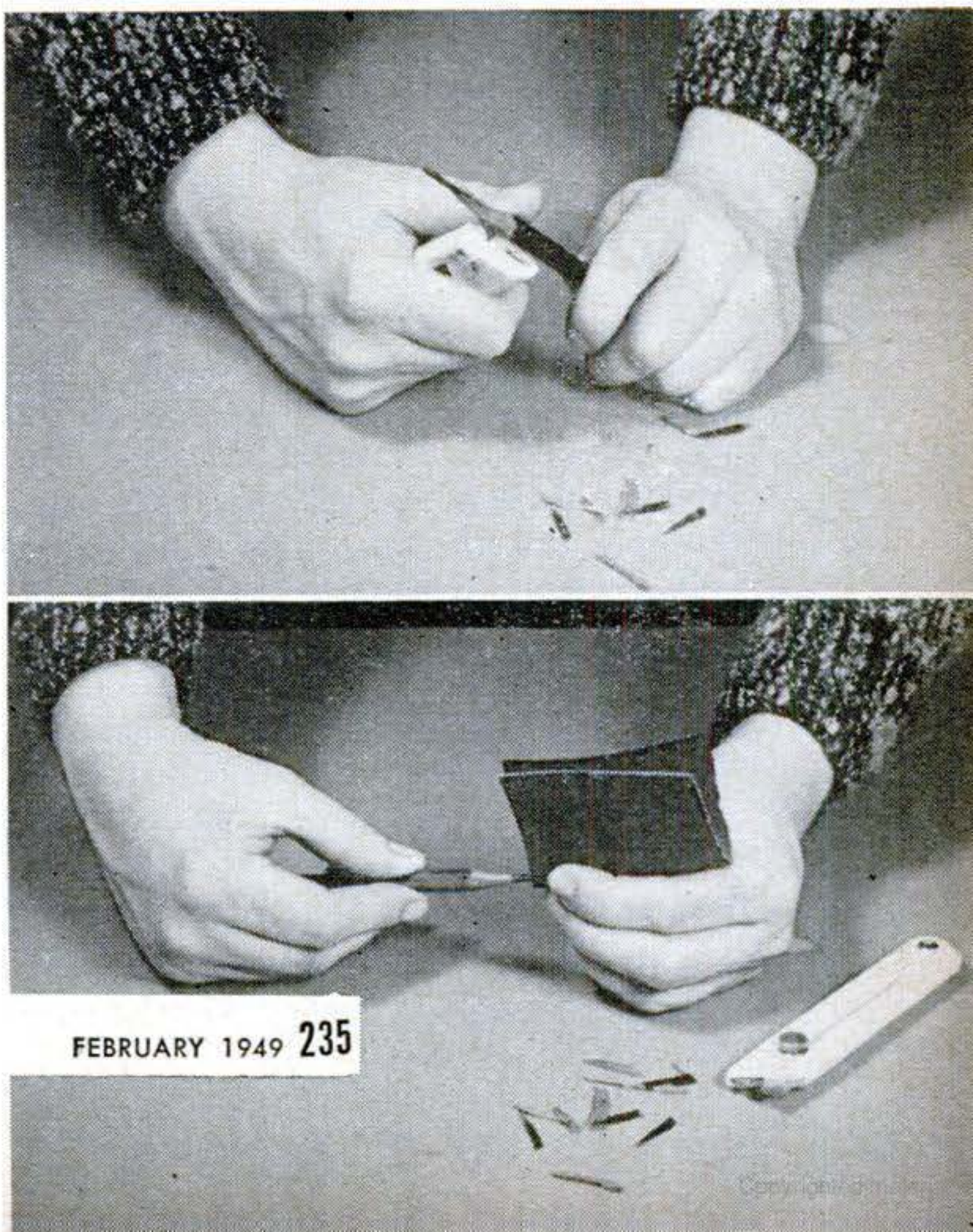
As you gain facility you will probably tend to rely more and more on a sable brush and spotting colors, but at the start try working with the pencil, particularly for the light and medium-grey areas. Pencil lead is a little easier to apply, especially on the rough surface papers, and you'll develop the feel of print spotting more quickly.

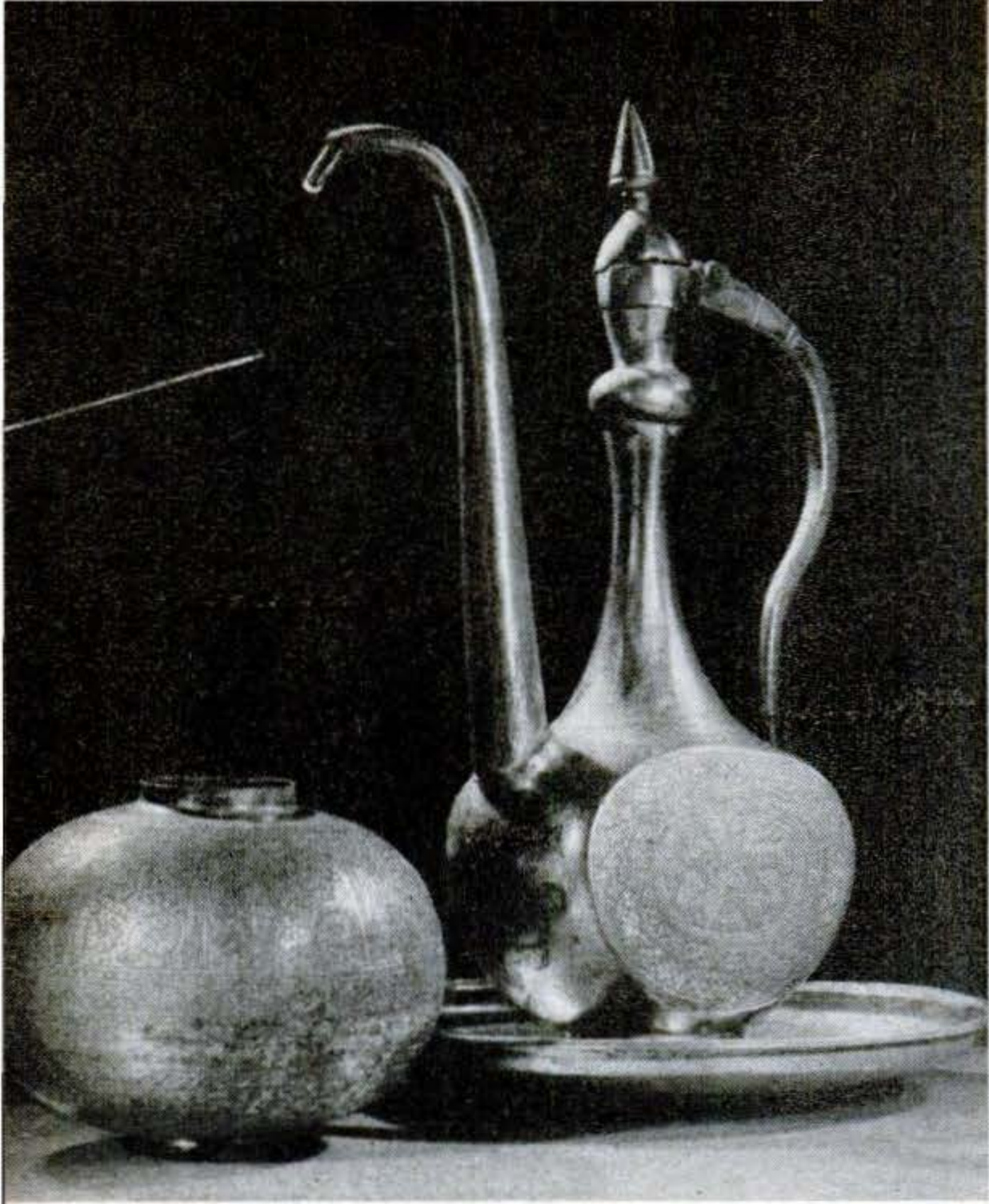
Do not attempt to draw crosshatches, circles, or figure-eights at first. The proper basic pencil stroke is a gentle jab that brings the lead in brief, light contact with the surface of the paper. Hold the pencil loosely in your fingers at any comfortable angle. For most persons this will be between 45 and 75 deg. from the horizontal. Start at the outer edge of the spot and work toward the center. It's easier to match tones that way.

Some workers do not attain success in print spotting because they try to lay down a perfectly uniform layer of equal density. This seldom produces satisfactory results. The spotted area will be either too light or

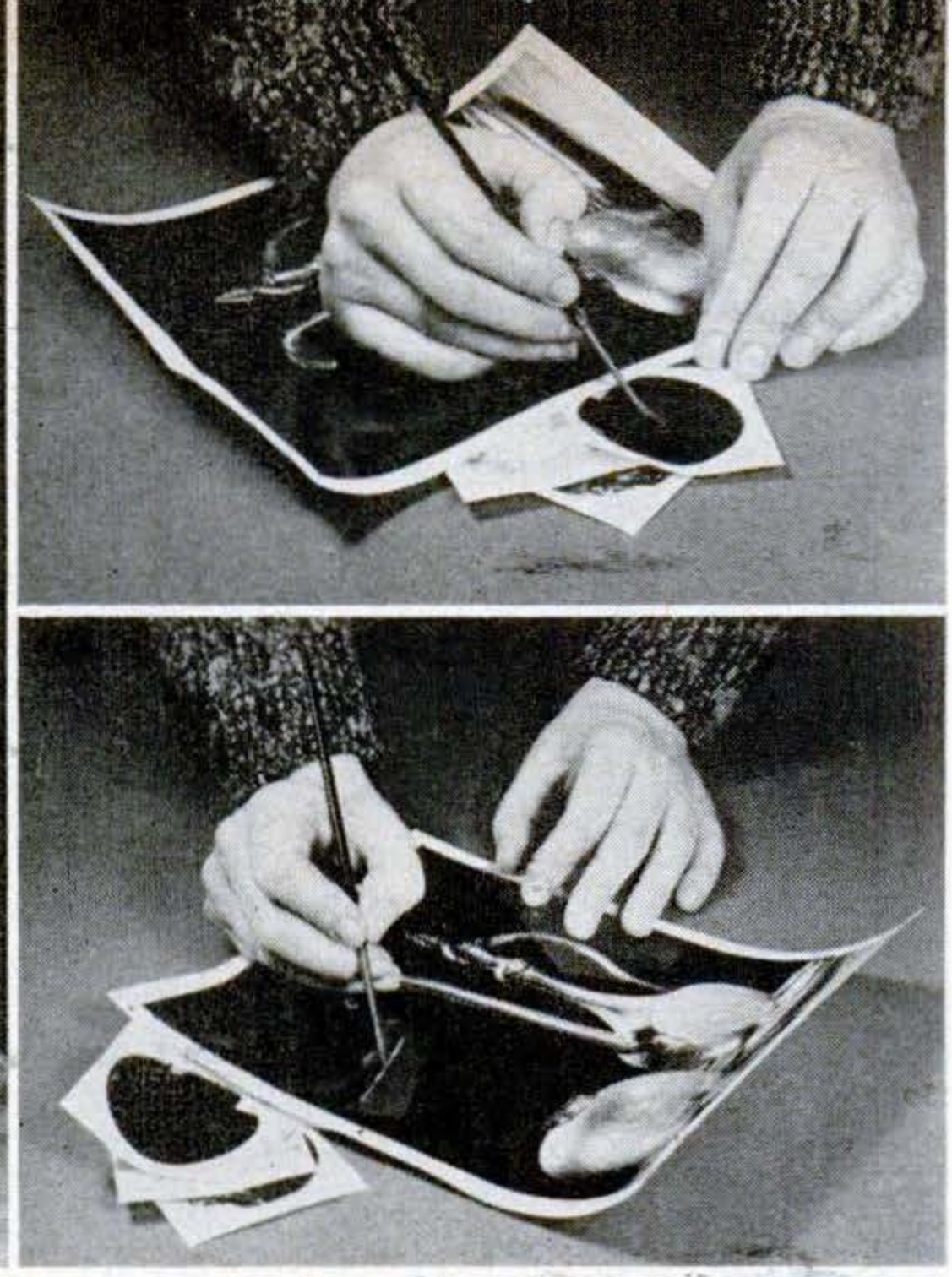
Dark spots in light areas of a print can be removed by bleaching with a dilute solution of sodium hypochlorite. Apply a drop of the solution, let it stand for a few seconds, and then wipe off with clean cotton as in the top photograph. If the bleached area is too light, spot with pencil until it matches surrounding area. Use pencil in a light stippling stroke.

For best retouching, the pencil point should be at least 2" long and sharp as possible. Cut away the wood with sharp knife or razor blade. Then bring the lead to a fine point by twisting in folded emery cloth or fine sandpaper. Exert pressure on cloth with fingers and the thumb of left hand while twisting with right. A delicate point makes you use light touch.





A deep scratch on the base side of a negative may cause a white line on the print. If such defects occur in a dark area, you'll get best repair by using a brush and spotting colors.



Charge the brush by moistening between your lips and then drawing across color patch with a twisting motion to form bristles into sharp point. Use the brush just as you would pencil.

too dark, depending on the pencil and the tone of the surrounding area. The aim should be to let white areas remain between the pencil dots. It is only by a proper distribution of dots and spaces—the mixture of grey and white—that you get a perfect match.

You'll understand this if you examine a halftone reproduction in a magazine or book under a magnifying glass. Notice that in the lightest areas of the picture the dots are small and rather widely separated. In the dark areas they're much larger and the white spaces between them are smaller. Keep this principle in mind as you work.

Although fine for very light and medium grey tones of a print, pencil retouching has certain disadvantages. It comes off if the surface of the print is rubbed. It won't take on ferrotyped glossy prints. And it's practically impossible to get a good color match with pencil in the very dark grey and black parts of a print.

To overcome these difficulties, it's necessary to turn to a sable brush and spotting colors. Work with the best sable brush you can get, one that's thin and soft so it can be brought to a sharp point.

Moisten the brush between the lips and pick up a charge of color—black, white, or sepia, as the situation requires—by twisting the bristles in the color patch. While doing this, hold the brush fairly flat so that about half the length of the bristles lie horizontally on the surface of the water color. Twist the bristles into a point by rotating the brush between your fingers as you pull it away from the color.

While at work, hold the brush exactly as you do a pencil. Use the same gentle jabbing motion. Allow only the extreme tip of the brush to touch the print. If the point spreads, use less pressure. Color goes on best when the brush is nearly dry.

There are two practical ways to spot glossy photos. If the print has been ferrotyped, the color can be applied over the glaze. The spot will be dull by comparison with the rest of the print. This can be overcome by picking up a little of the mucilage from an envelope after charging the brush with color.

The other method is to dry the print on blotters or cheese cloth and do the spotting on the unglazed surface. Then soak the print in a tray of *still* water and ferrotype it. This is the best procedure, for the spotting will then be under the glazed surface—protected and practically invisible. END

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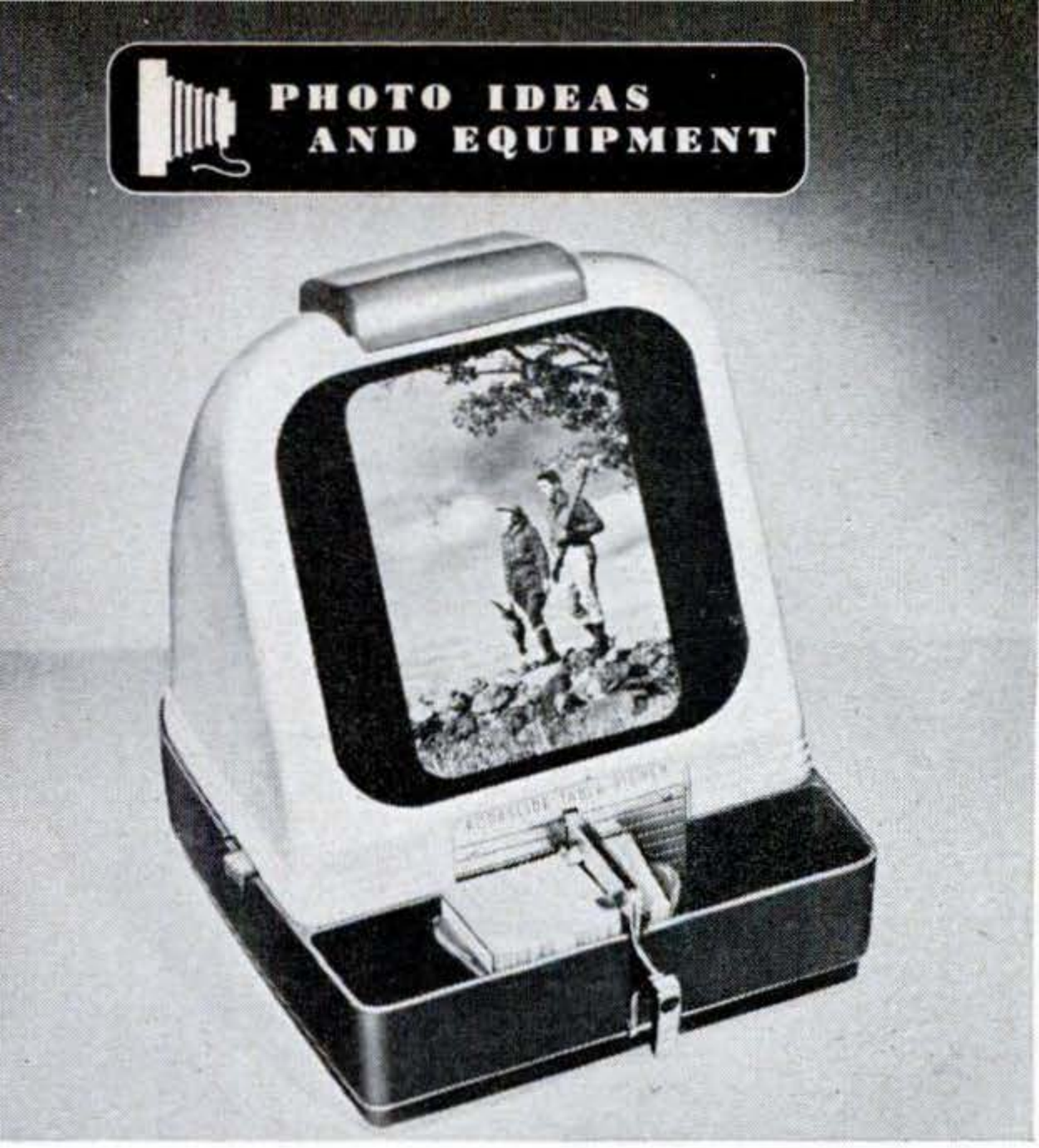
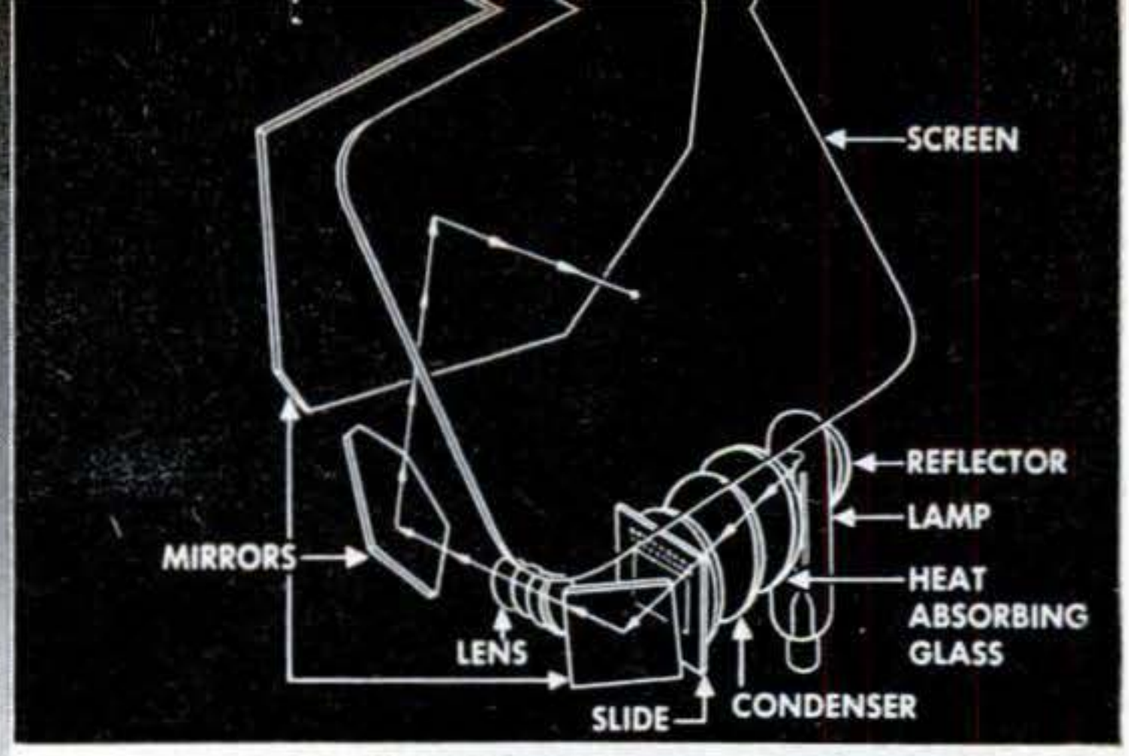
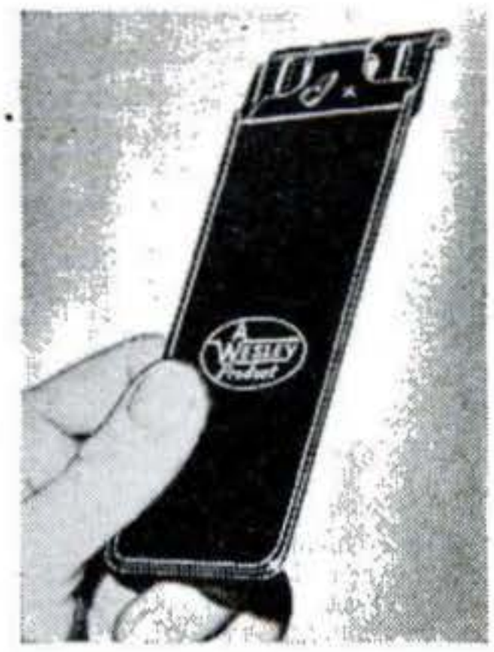


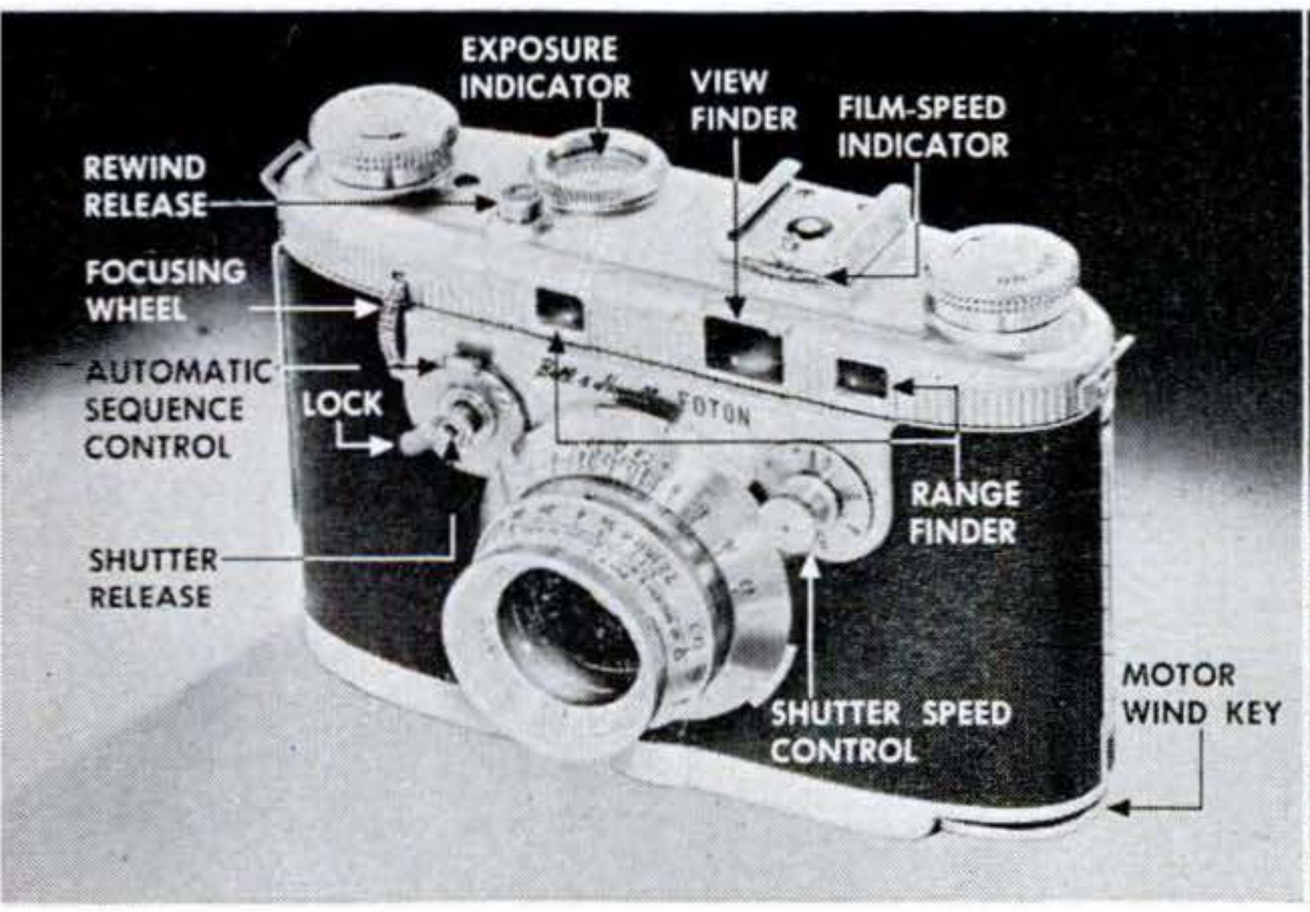


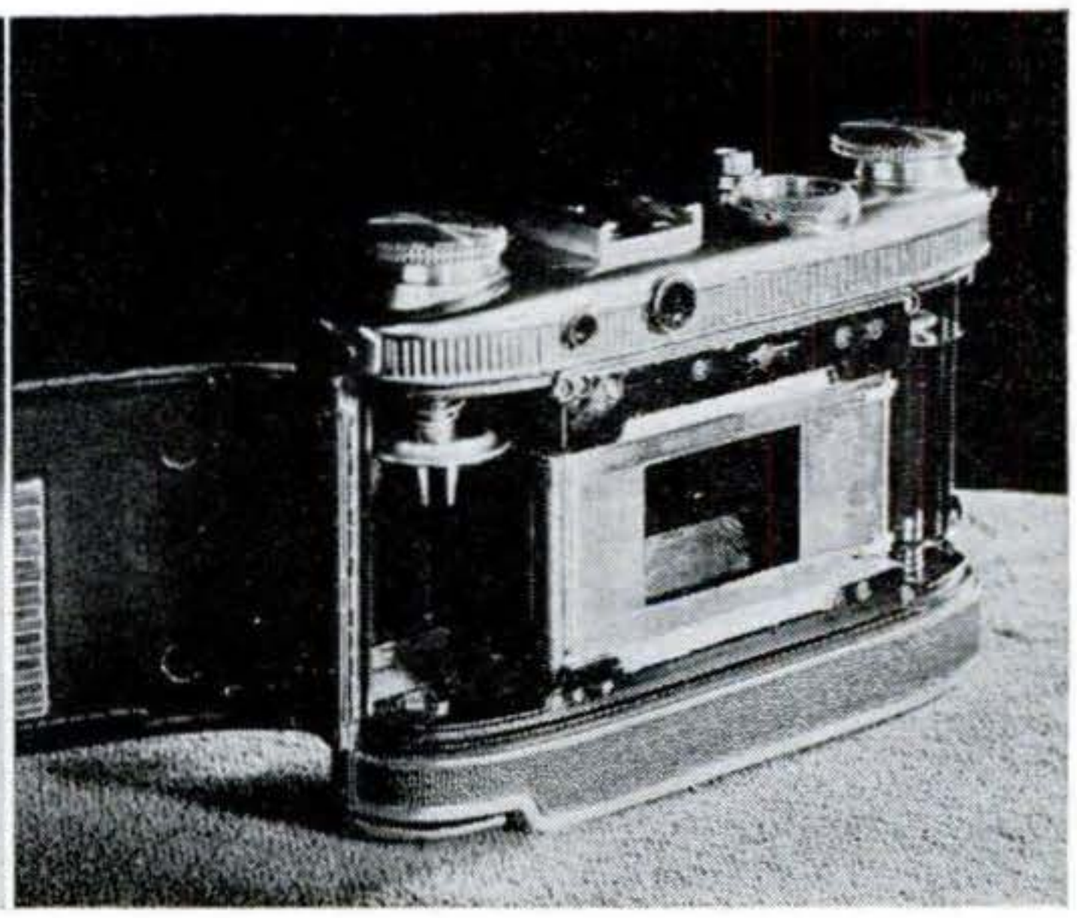
Slide Viewer Has 7½" Screen. Occupying less than 1 sq. ft. of table space, the Kodaslide Table Viewer® incorporates a complete projection system for miniature photo transparencies. The diagram above shows operation of the viewer. When a slide is pushed into position, the 75-watt lamp is turned on. It's automatically shut off when the slide is withdrawn. The Eastman Kodak Co. offers the viewer at about $95.

Pocket-Size Viewer. The Mini-Vuer® for 2" by 2" transparencies is made of plastic by the Craftsmen's Guild, Hollywood, Calif., to sell at $1. Curved design of the slot makes handling of slides easier and quicker.



Wafer-Thin Film Holder. This 2¼" by 3¼" cut-film holder weighs only 4/5 oz. and is 3/16" thick. Construction is one-piece aluminum. It is priced at $1.25 by the Wesley Manufacturing Co., Chicago.





Miniature Is Fully Automatic. The Bell and Howell Company's new Foton® features a built-in spring motor that advances the 35-mm. double-frame film and also winds the shutter. Besides single shots, the Foton also shoots bursts of 15 frames in rapid sequence at the rate of four or five a second. This camera introduces the T/ stops instead of f/ stops. T/ stops are determined by the actual nonabsorbed amount of light the lens transmits. With a 2" T/2.2 (f/2) lens, the Foton is priced at $700.

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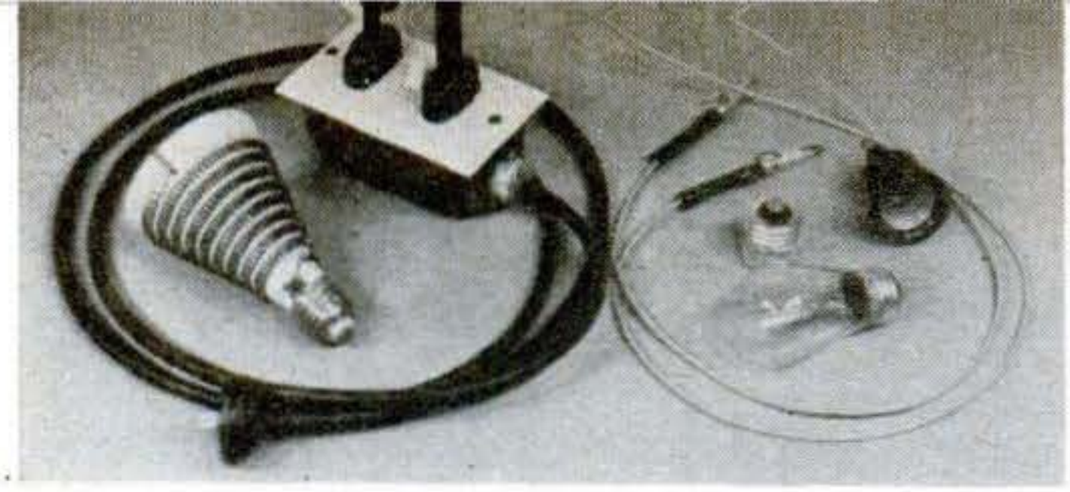
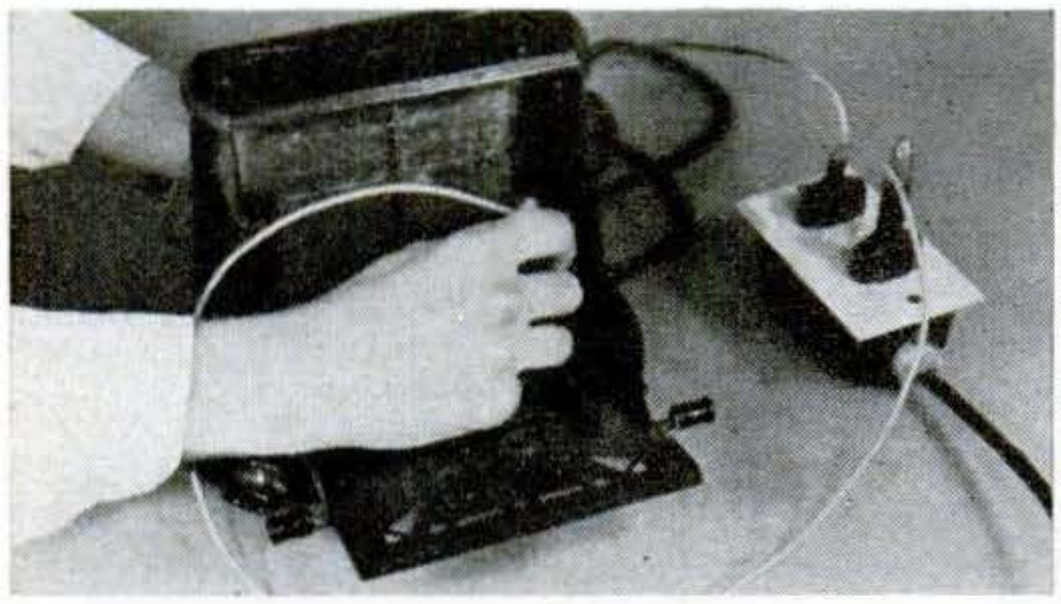
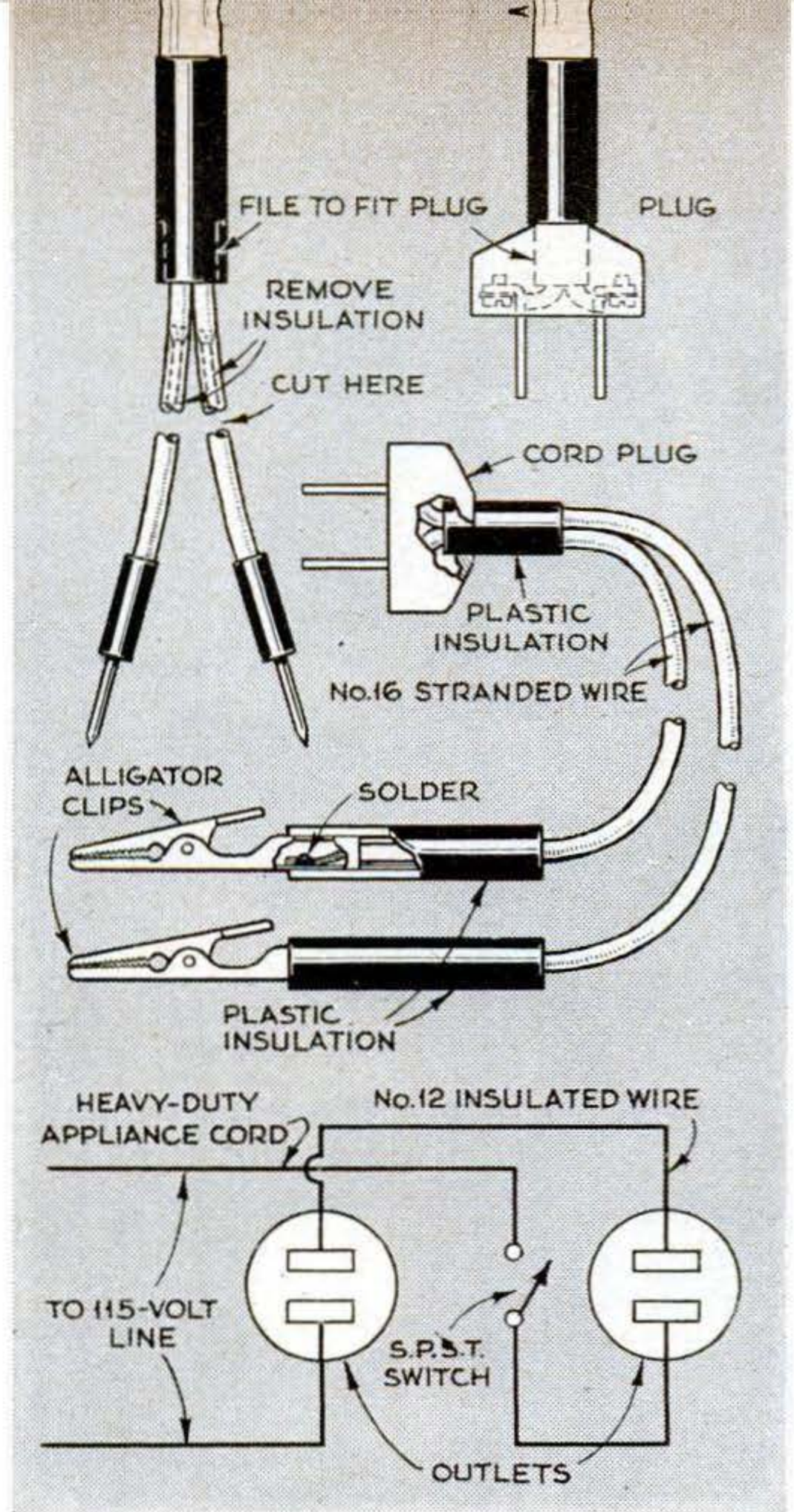


Accessories for the tester include a heating element, fuse, lamp, prods, and socket adapter.



A neon tester, converted as shown at the right, can be used for testing various appliances.



Tester Built in Outlet Box

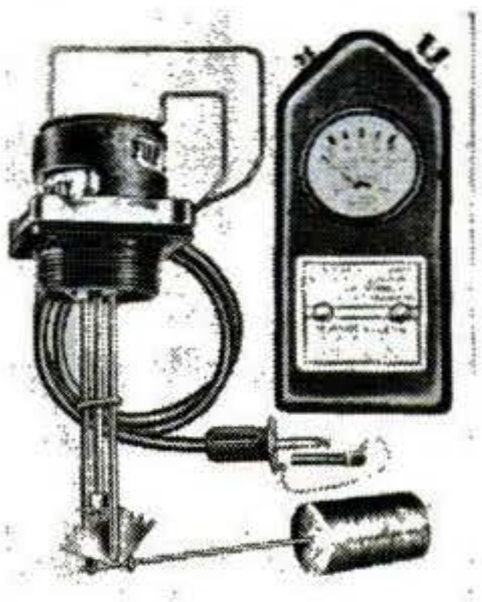
WHETHER you use it as a continuity checker, a voltage reducer, or a fused, portable outlet, this versatile tester will soon earn a place in your shop. It is made of standard electrical parts including an outlet box, 8′ of heavy-duty appliance cord, a three-hole cover and anchor plate, clips, two outlets, and a SPST switch. Place the switch in the center and the outlets on either side.

A plug-in adapter for screw bases, neon tester, 10-watt bulb, heating element, and fuse are also needed. The neon tester or bulb will check for continuity or shorts in various applications. Use the heating element or a bulb in one outlet to reduce voltage at the other for operating low-voltage equipment. With the fuse inserted, you have a portable outlet for testing doubtful appliances. A 10-amp fuse should be about right.—*Don G. Pittwood, Moscow, Idaho.*

Spray Adapter Clamps on Can

A SPRAY adapter for five-gallon paint containers has been announced by The Silver King Company, Chicago. The device consists of aluminum top and bottom covers that clamp to the can by means of wing nuts. It also includes a gauge, regulator, and safety valve. Paint outlets fit standard equipment. The spray is featured as a time and labor saver in industrial applications.

Outside Gauge Tells Oil Level



LESS wasteful fuel-oil delivery may result from this remote indicator made by Rochester Manufacturing Co., Rochester, N. Y. The tank-gauge unit is connected by a cable to a plug near the filling pipe. Connecting the indicator, right, the delivery man gets automatic readings of the fuel level, telling him how much to deliver and when to slow and stop to prevent overflowing.

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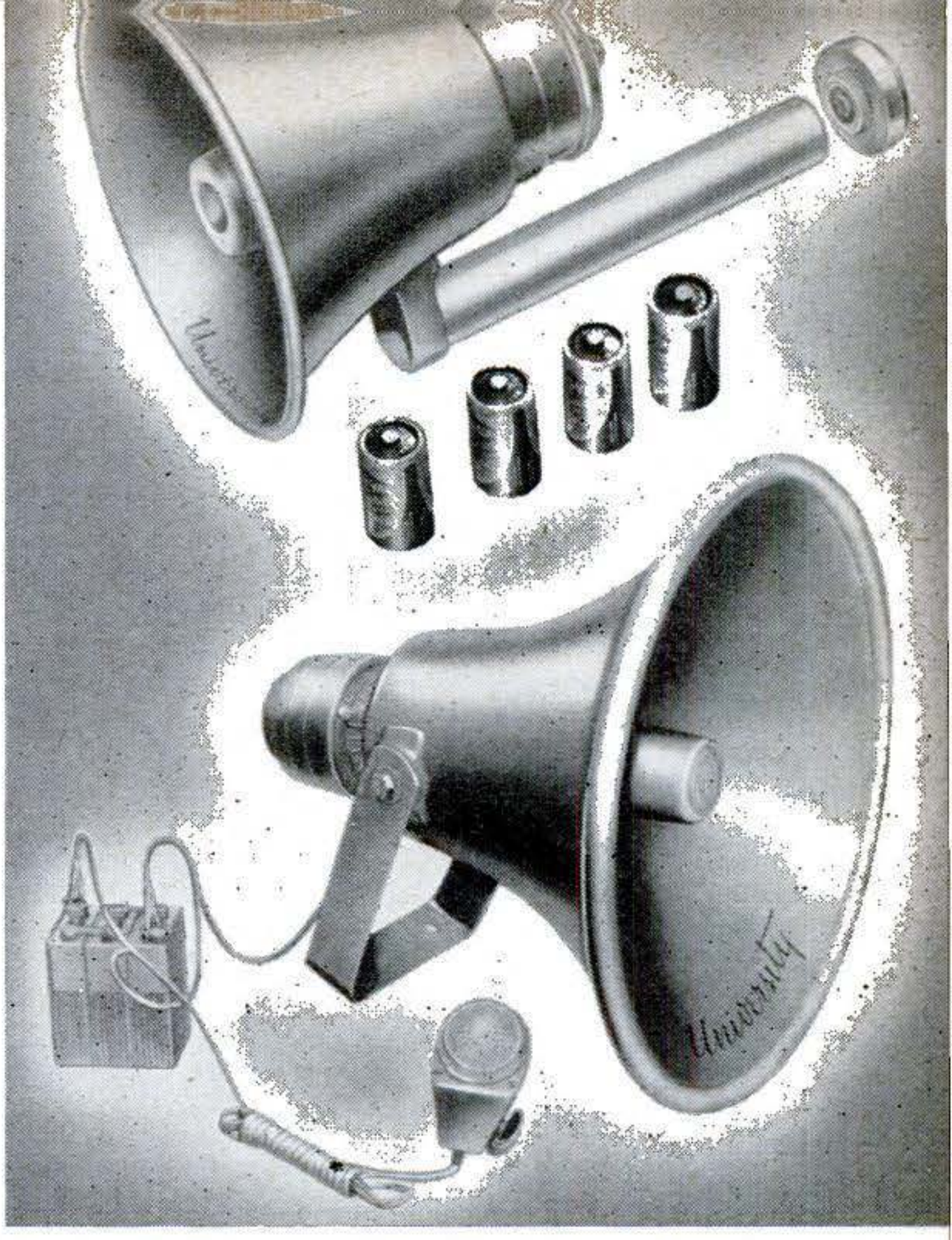
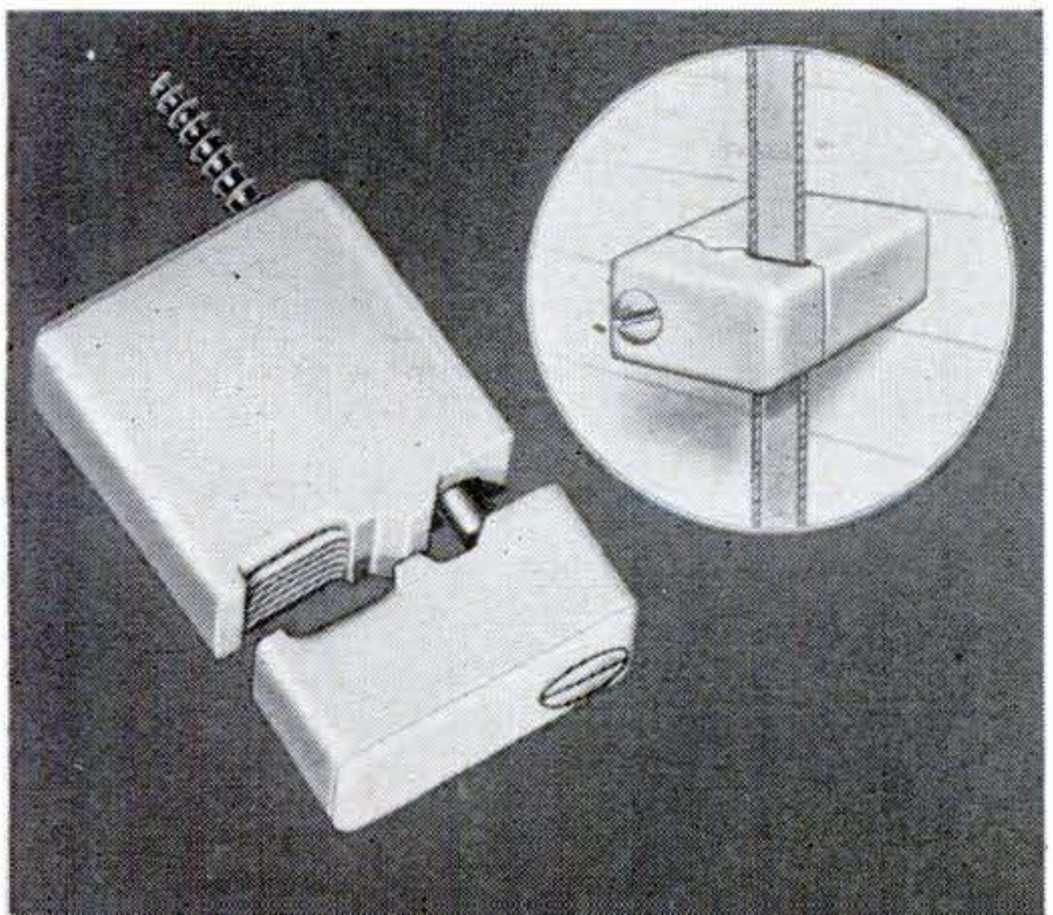
Extra Screens Copy Pictures. Television programs tuned in on a master set can be duplicated on as many as 12 extensions. Each is a complete receiver minus the tuning section. It has an on-off switch and volume control; all other adjustments are made at the master. No special installation or separate antenna is required. Olympic Radio & Television Inc., Long Island City, N. Y., is the maker.

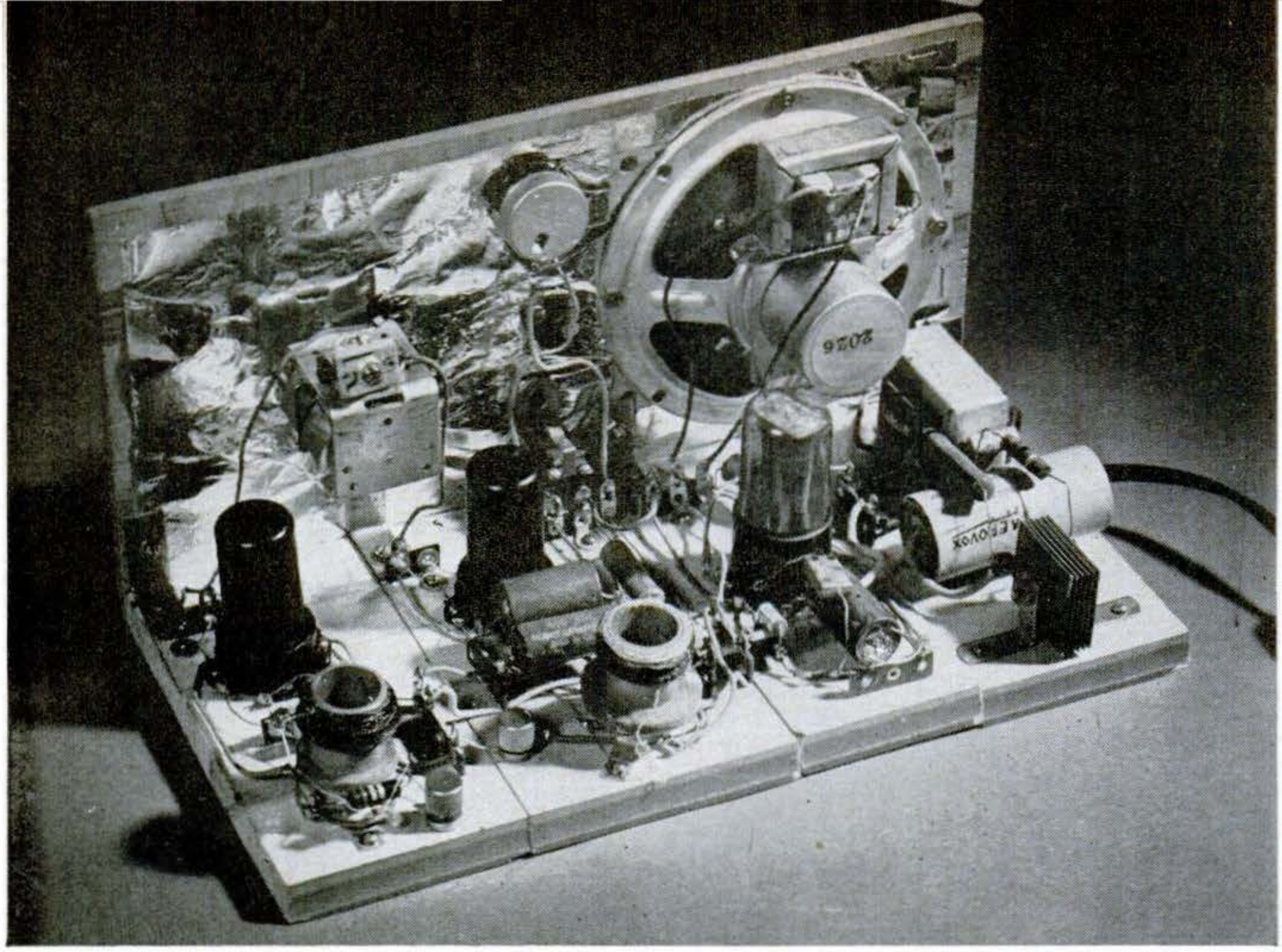


Sound System Omits Amplifier. A new Power Mike®, from University Loudspeakers, Inc., White Plains, N. Y., uses batteries but no tubes or amplifier. It converts sound waves to electrical impulses, delivering several watts of power to a speaker. Two applications are shown above. The simplest hookup, lower view, uses a storage battery and reflex speaker; top, a megaphone operating on flashlight cells.

Supports Hold Flat Lead-in. Stand-off insulators and supports for the flat twin-wire lead-in widely used in television and FM antenna installations are made in several popular sizes by Porcelain Products, Inc., Findlay, Ohio. The supports are said to improve reception by keeping the wire rigid without damage to the insulation. Quick moisture drainage lessens the possibility of short circuits.

Adhesive Tabs Fix Speakers. To bypass the familiar procedure of repairing torn speaker cones with liquid cement and pieces of paper, the Walter L. Schott Co., Beverly Hills, Calif., packages an assortment of adhesive patches. The entire repair consists of selecting a suitable patch, removing the protective backing paper, and pressing the gummed surface over the hole in the cone.





Start with a one-tube receiver and add stages. This set gets better as it gets bigger.

Beginner's Radio Grows by Stages

By Albert Rowley

HAVE you ever thought of budgeting a radio? That is, investing small quantities of money, time, and study until they add up to the finished job you want? If you now have a nodding acquaintance with the electronic art, you'll learn a great deal more by watching this radio work as it grows. For a few dollars and even fewer evenings you can build yourself a one-tube-plus-rectifier receiver that will bring in most of the local stations at comfortable headphone volume.

Later, at your leisure, you can add another tube to increase the range and selectivity of the set. Then—like building with blocks—you can add a third tube to complete the job. You'll have a three-tube loudspeaker radio that makes a fine extra set for the workshop or even a fill-in upstairs.

As can be seen from the photos, the building-block idea is an actual method of construction. Each of the four stages is built on a slab of wood ½″ thick and 6″ long. They vary slightly in width, the detector stage being 3½″ and the audio 2½″, while the rectifier and RF units are each 3″ wide. This adds up to 12″, which is the width of the front panel to which all four units are ultimately attached.

The first set to make is the one-tube regenerative receiver consisting of units 1 and 2—the detector and rectifier stages. If you want to see what the schematic of this set looks like, fold page 243 down the center. Now fold up the left-hand column along its center. This covers up unit 4 and brings units 1 and 2 together.

On the detector block, drill or saw out a ⅞″ hole centered about 2″ from the front edge.

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Mount an octal wafer socket with the prongs fitting into the hole and the base of the socket flush with the board. The lugs to which connections are soldered can be bent over to rest flat on the board. Wood screws hold down the socket, coil L1, and the half dozen terminal strips that are used to anchor the fixed resistors and condensers. Predrilling the screw holes makes the assembly easier.

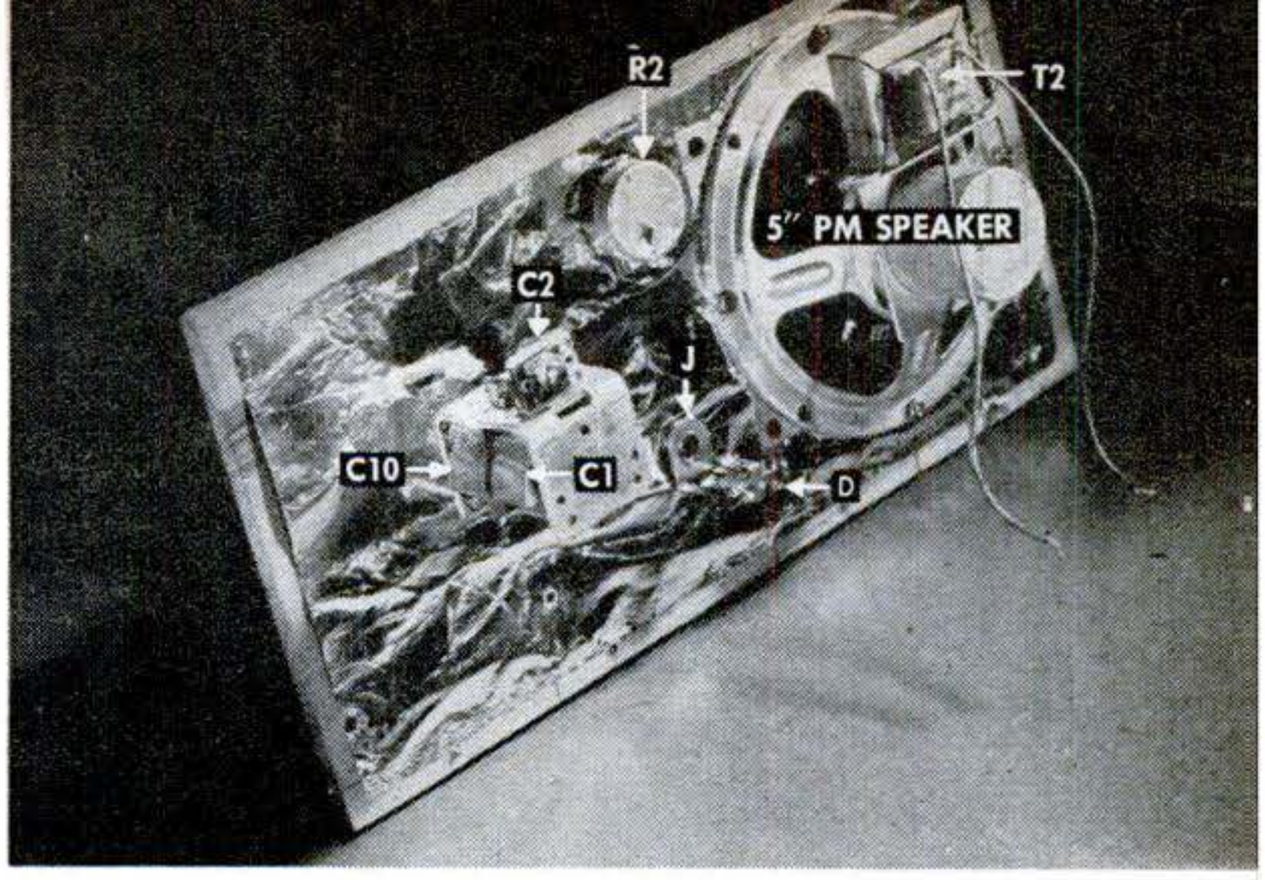
An air-core RF coil is used in this stage as the antenna coil. The plate lead (A) is connected to an external antenna and the B-Plus terminal (B) goes to the point marked C in the diagram. The other two leads are wired in the usual fashion to grid and ground.

Before you do any wiring on the detector stage, wind 15 to 20 turns of No. 34 D.C.C. wire around the ground end of the secondary or grid winding. This will become the tickler coil (L2) and will serve to feed back some of the signal to the grid in order to build up amplification. The amount of feedback is controlled by the 5,000-ohm potentiometer, R2, which makes it, in effect, the volume control.

Ground connections are brought to a 1″ angle bracket mounted flush with the front edge of the block. A soldering lug under the wood screw that fastens the bracket collects the ground leads. No connection is made to the phone jack terminal marked D in the diagram.

When the detector block is assembled, start on the rectifier. A feed-through switch is cut into the line cord to turn the power on and off. The two leads coming from the switch are anchored to a 2-lug terminal strip. Solder the pigtails of a .01-mfd. condenser (C9) across the same two lugs.

A filament transformer for the 6-volt tube heaters and a dry-disk selenium rectifier are the principal components of the rectifier stage. Output of the dry disk, as filtered by R5, and the dual electrolytic, C7, C8, feeds about 100 volts of direct current to the B-plus line going to the other stage or stages.



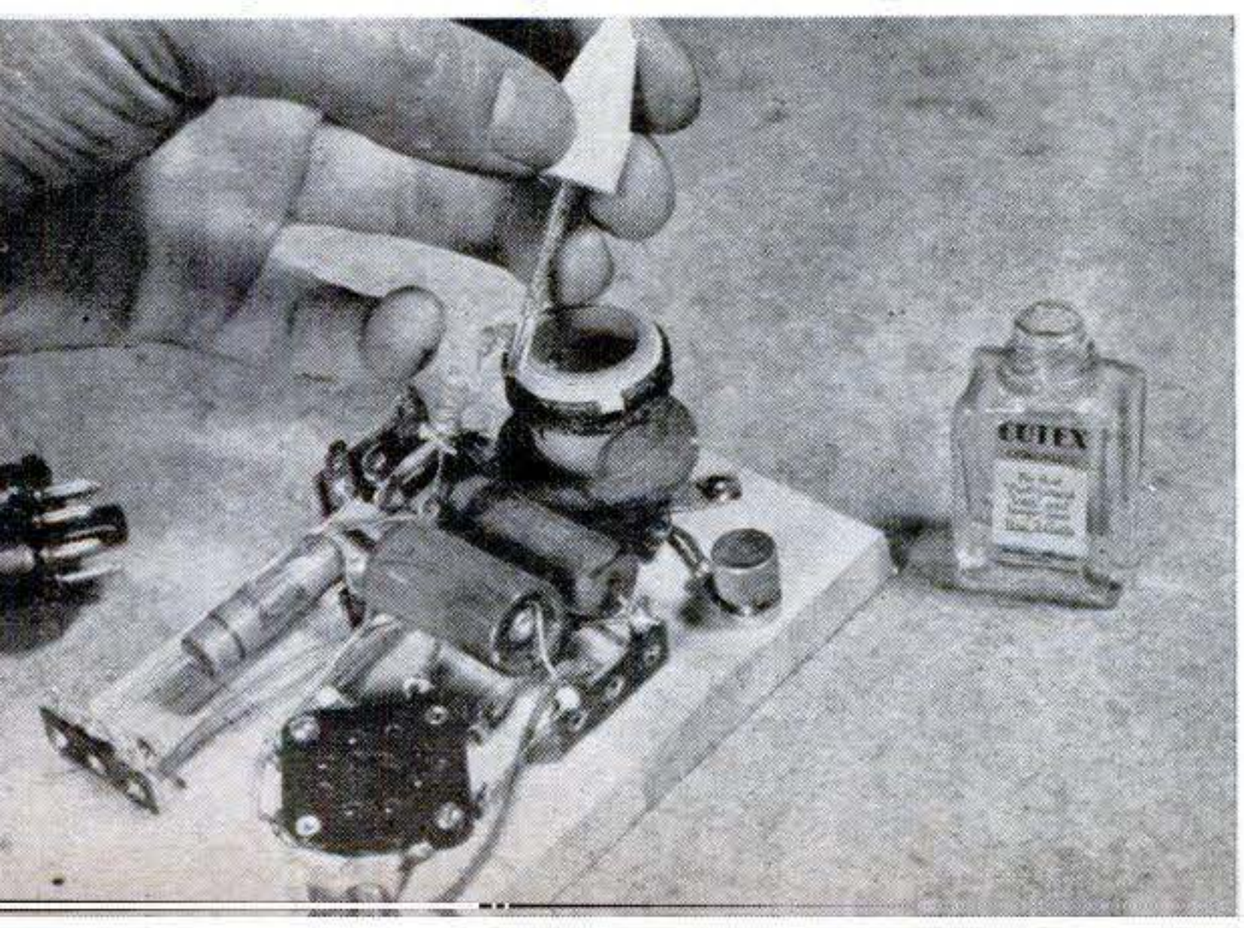
Aluminum foil stapled to the front panel acts as a common ground or chassis and also provides shielding for the variable condenser.

One leg of the angle bracket on each block is bolted to the front panel. This panel is backed by a sheet of aluminum foil or tinfoil stapled or tacked to the board. The foil serves as a shield for the tuning condenser and also as a common ground return.

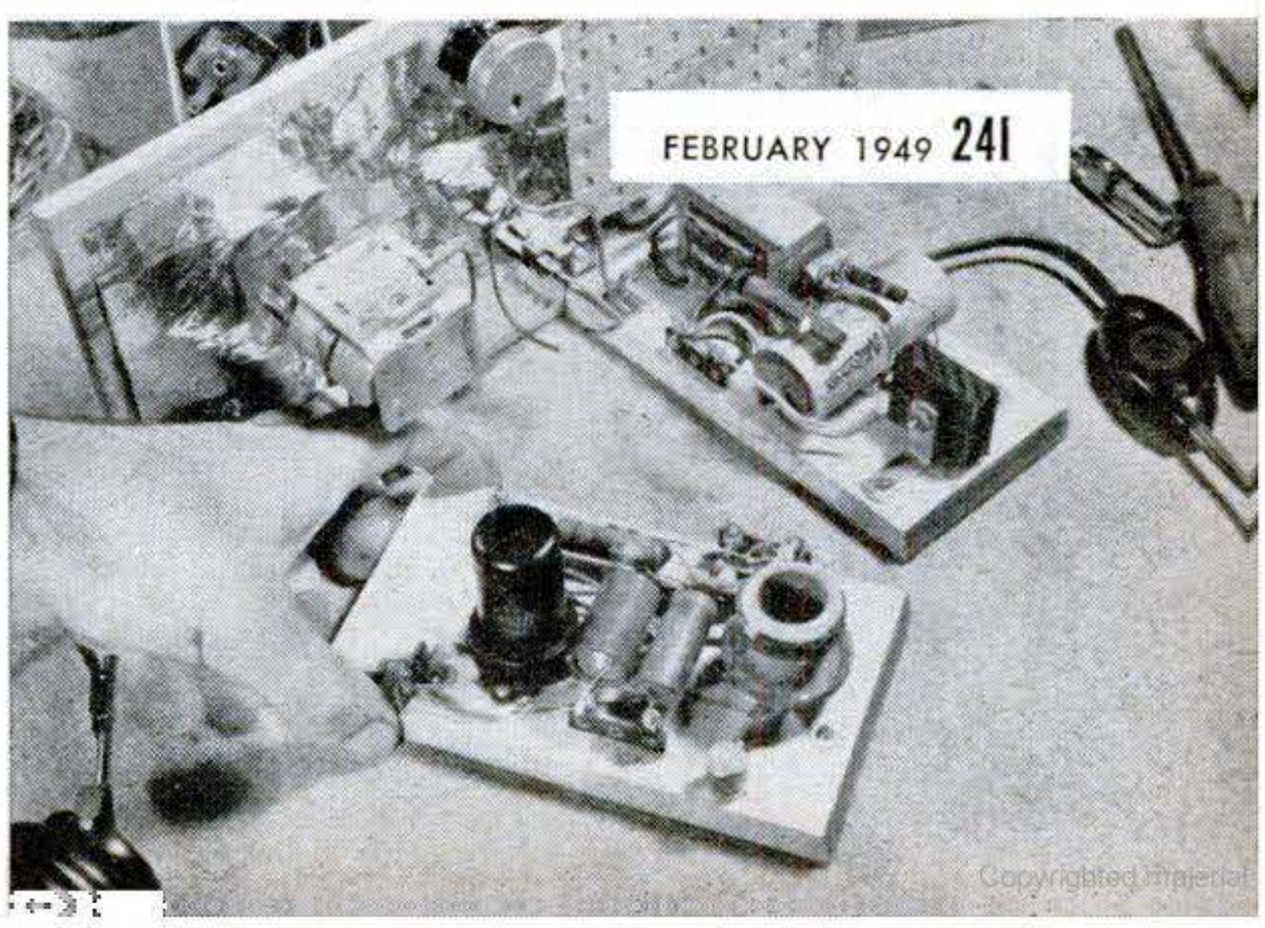
If you plan to build all four stages of the receiver in time, you can save yourself some work by completing the front panel right at the start. It is a ¼″ by 6″ by 12″ board on which are mounted a two-gang tuning condenser, closed-circuit phone jack, and 5,000-ohm potentiometer. A trimmer might be included in this list although it is actually attached directly to the frame of C1. The only parts that will have to be added later are the 5″ PM speaker and output transformer. A grille for the speaker is made by drilling seven or eight rows of ¼″ holes spaced ½″ apart. If you don't have an electric drill or drill press, you may find it easier to jigsaw an opening and cover it with a cloth.

In this one-tube set, impulses that reach the external antenna are brought down into

The coils in both the detector and RF stages must be altered. Nail polish is an effective coil dope for sealing new turns in place.



First of three sets you can make with your building-block receiver. It's a regenerative detector employing one tube plus rectifier.



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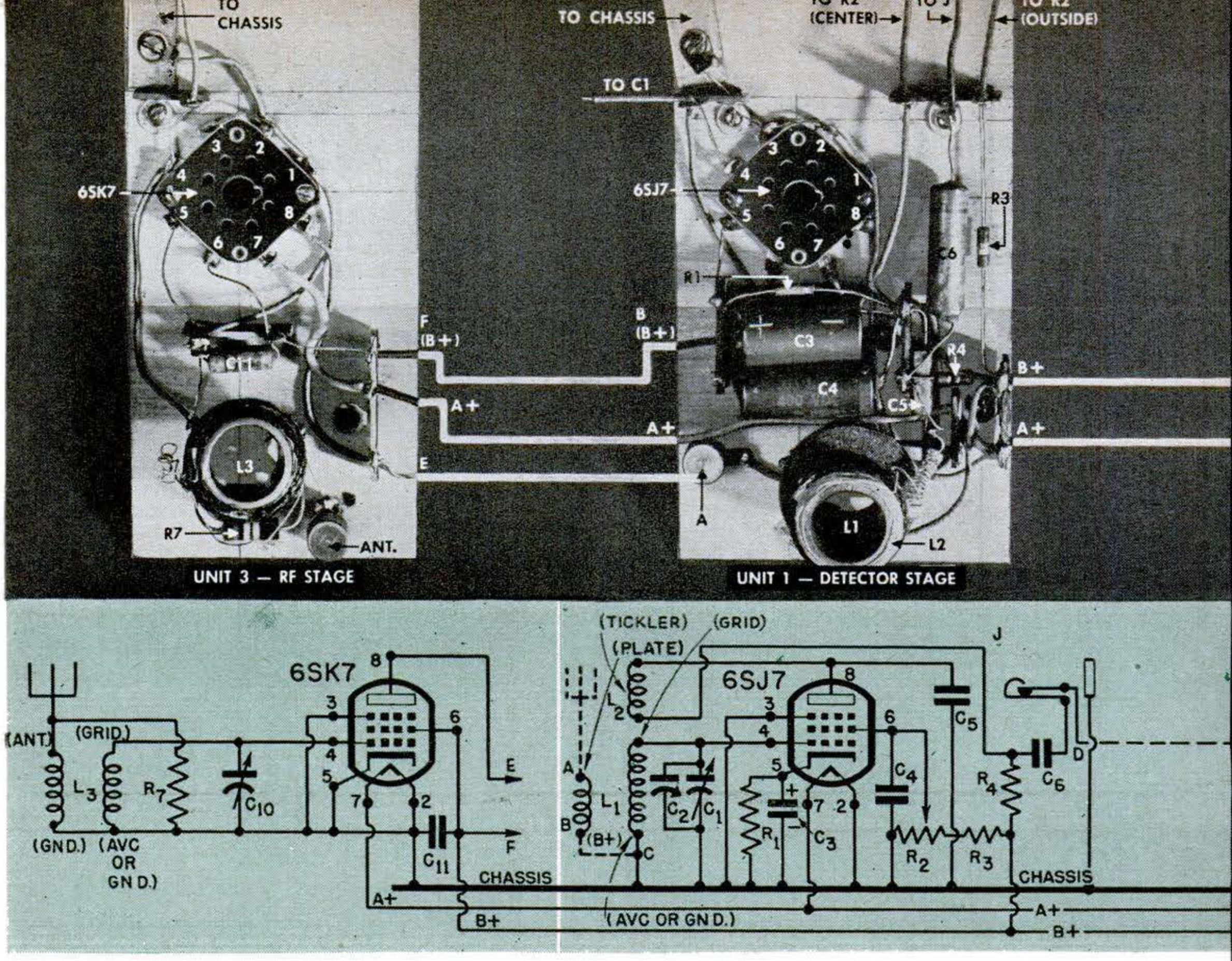

the primary winding of the RF coil. By induction the coil transfers them to the secondary winding where the tuning condenser (in parallel with this part of the coil) selects one particular signal from the jumble.

This selected signal goes to the control grid of the 6SJ7 detector tube. It is then demodulated—that is, the radio-frequency component or carrier wave is rectified and filtered out, leaving only the audio-frequency voltage to energize the headphones.

In order to increase the amount of amplification that can normally be obtained from a single tube, part of the signal is fed back from the plate to the grid through the tickler winding.

If you'd like to add pep to the headphone signals, bring in weak ones with greater strength, and capture some new ones that you can't get at all, try adding a stage of radio-frequency amplification. Unit 3, the RF stage, is assembled in much the same way as the detector. Antenna coil L3 should be of the same manufacture as L1.

LIST OF PARTS

UNIT 1 (DETECTOR)

R1: 33,000-ohm, ½-watt carbon.
R2: 5,000-ohm potentiometer.
R3: 50,000-ohm, ½-watt carbon.
R4: 100,000-ohm, ½-watt carbon.
C1: Second section of 2-gang tuning condenser, .00041 mfd. each section.
C2: 4-80 mmf. variable trimmer.
C3: 4-mfd., 150-volt electrolytic.
C4: .05-mfd., 400-volt paper.
C5: .0001-mfd. mica.
C6: .01-mfd., 400-volt paper.
L1: Air-core RF coil.
L2: Tickler coil (see text).
J: Closed-circuit phone jack.
Octal wafer socket and 6SJ7 pentode.

UNIT 2 (RECTIFIER)

R5: 1,000-ohm, 2-watt carbon.
R6: 15-ohm, 1-watt carbon.
C7: 50-mfd. } 150-volt dual electrolytic.
C8: 30-mfd. }
C9: .01-mfd., 400-volt paper.
S1: On-off feed-through switch.
T1: 6.3-volt, 1.2-amp. filament transformer.
SR: 100-ma. selenium rect.
Line cord and plug.

UNIT 3 (RF)

R7: 27,000-ohm, ½-watt carbon.
C10: Front half of 2-gang tuning condenser (See C1).
C11: .01-mfd., 400-volt paper.
L3: Air-core Ant. coil. (See text).
Octal wafer socket and 6SK7 pentode.

UNIT 4 (AUDIO)

R8: 1-meg., ½-watt carbon.
R9: 200-ohm, ½-watt carbon.
C12: 50 to 100 mmf. ceramic or mica (see text).
C13: .0033-mfd., 400-volt paper.
C14: 4-mfd., 150-volt electrolytic.
T2: Output trans. (see text).
5" PM speaker, octal wafer socket and 6K6-GT pentode.

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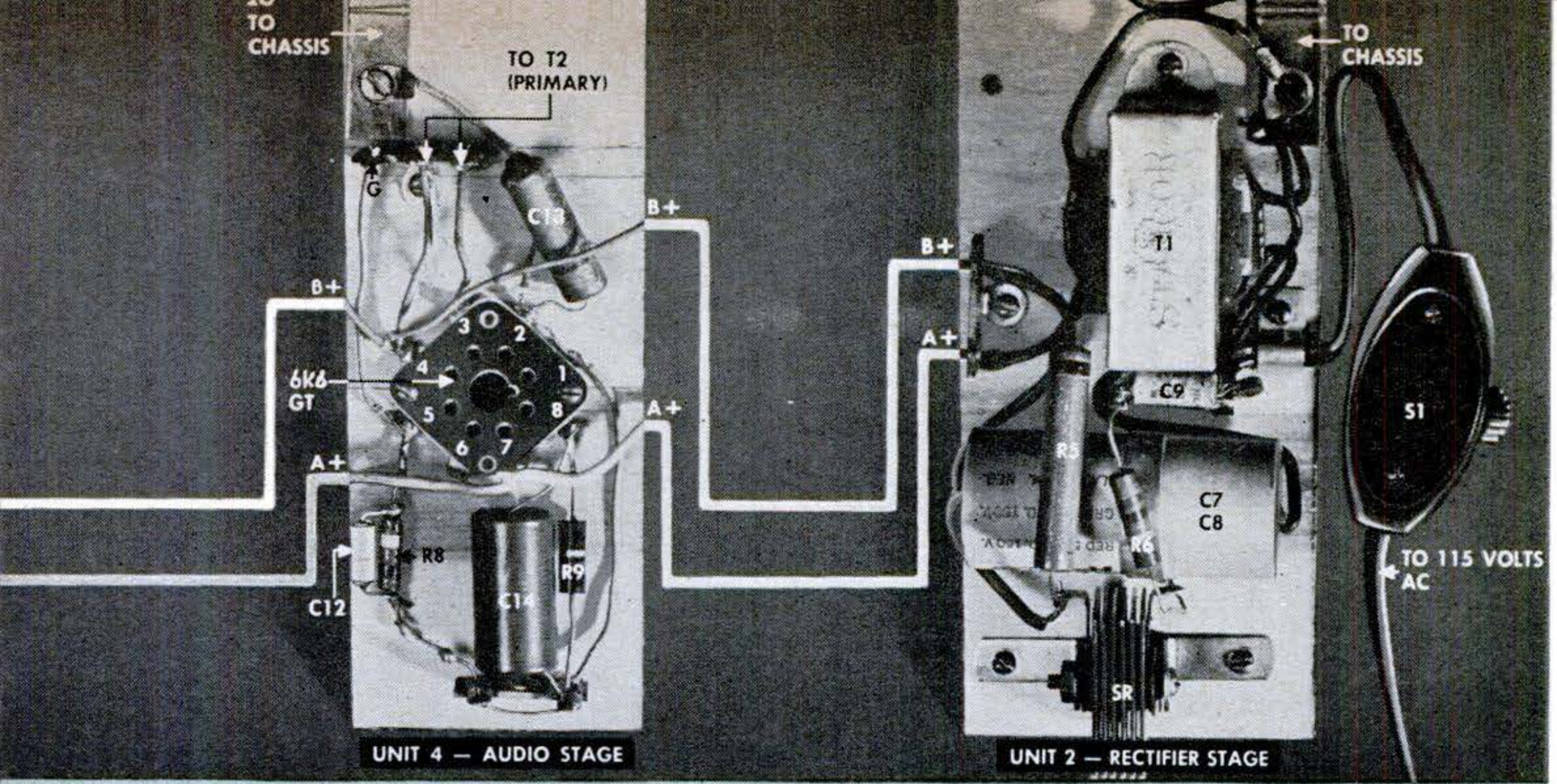

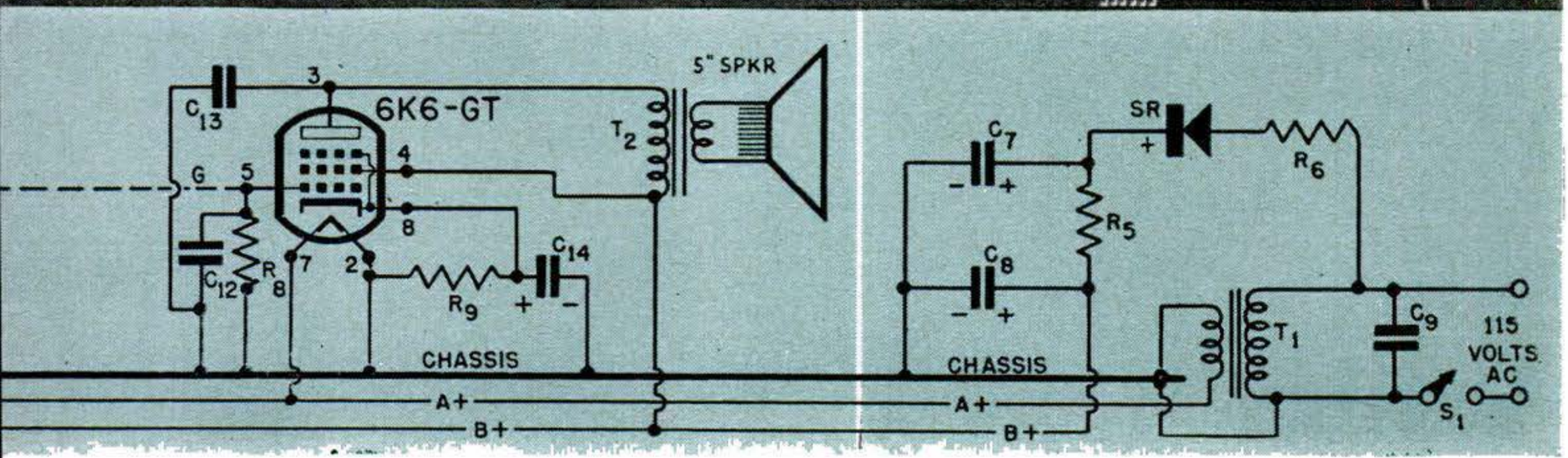

Matching the coils is important, or the two sections of the tuning condenser won't align correctly. Even buying a pair, however, won't insure matching in this case, because the addition of the tickler winding tends to upset the balance. To remedy this condition, remove about ten turns of wire from both the primary and secondary windings of the antenna coil.

When the RF block is finished, connect the grid of the 6SK7 to the front section of the two-gang tuning condenser (C10). Remove the external antenna from point A and connect it to the antenna terminal of L3. Break the connection from B to C and connect A to E and B to F.

In this setup, incoming signals are first tuned by C10, the variable condenser across the secondary of the atenna coil. The selected signal is amplified in the 6SK7 and coupled to the detector by means of the RF coil, which has been restored to its proper function. Having a stronger signal to start with, the detector stage can now produce greater output.

Although this two-tuber will get more than the one-tube job, it is still a headphone receiver. If you want to strengthen the signal enough to get loudspeaker volume, add a stage of audio amplification (Unit 4). Connect point D on the phone jack to G, the grid pin of the 6K6.

In order to obtain the correct match between the plate of the 6K6 and the speaker, you need an output transformer with a primary impedance of 10,000 to 12,000 ohms and a secondary of the proper rating for the voice coil of the speaker you will use.

Note the 50-mmf. ceramic condenser (C12) across the grid resistor. The capacity of this condenser is far too low for it to have any effect on the tone of the set. It is used to increase the amount of feedback getting to the grid of the detector tube when the audio stage is added. Although it is wired to the grid of the 6K6, it is effectively located between the plate of the 6SJ7 and ground. This capacity must be kept low in order to prevent oscillation. However if 50 mmf. doesn't provide enough feedback, try raising the value of C12 to a maximum of 100 or 150 mmf. END

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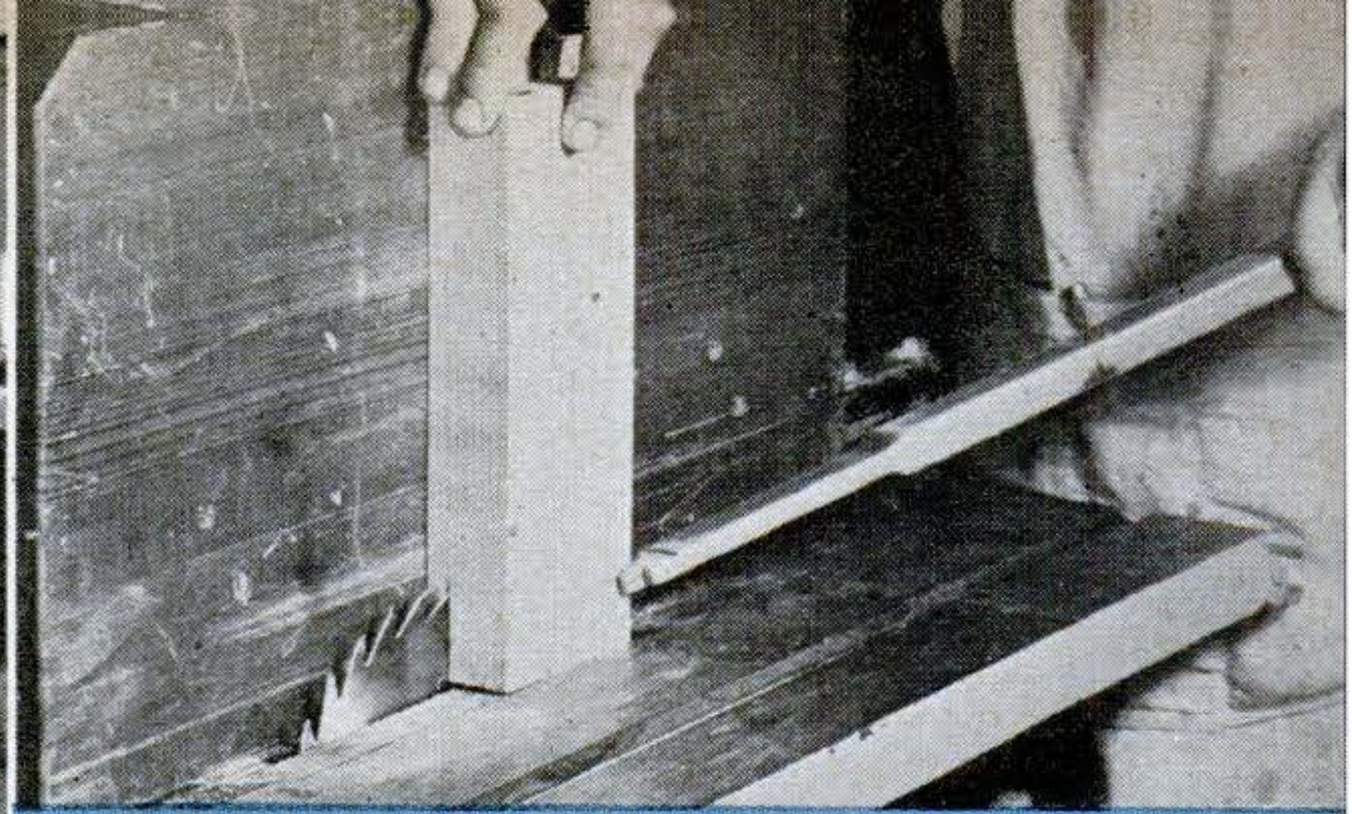
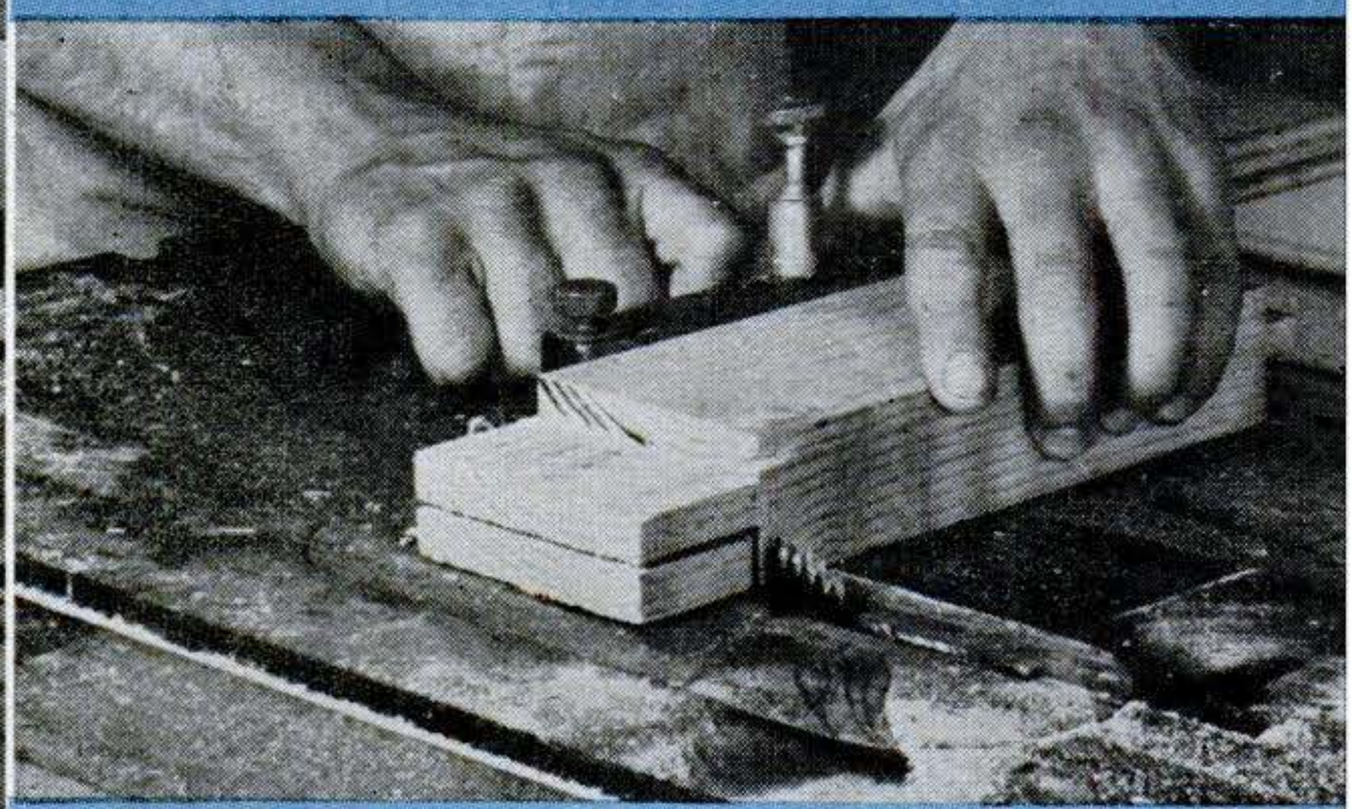


1. Ripping a cheek. One setting will serve for both cheeks of a tenon centered on thickness.



4. Make the shoulder cuts with the blade set to cut about half way into the ripped kerfs.

Tenoning with Power Tools

Your circular saw and drill press take the labor out of making mortises and tenons. Some of the other standard tools are helpful, too.

By Edwin M. Love

A FEW accurate saw cuts will shape a tenon on the end of any piece of wood. Which is practically the same as saying that the job is made to order for a circular saw. Given your choice of home-workshop power tools, you'll probably take advantage of the speed and precision of a bench saw for making the tenon half of the mortise-and-tenon joint. You can follow roughly the same sequence and methods as described for the hand operation last month.

If you have planed the piece exactly to thickness, one setup will do for both cheeks of a tenon that is centered on the thickness of the lumber. Mount a rip or combination blade on the arbor and lock it to project above the table an amount equal to the length of the tenon you want. To keep the stock upright, clamp a high auxiliary fence to the ripping fence and adjust its distance from the saw for cutting a cheek. In making this setting, take into account the width of the kerf, measuring first on scrap stock if

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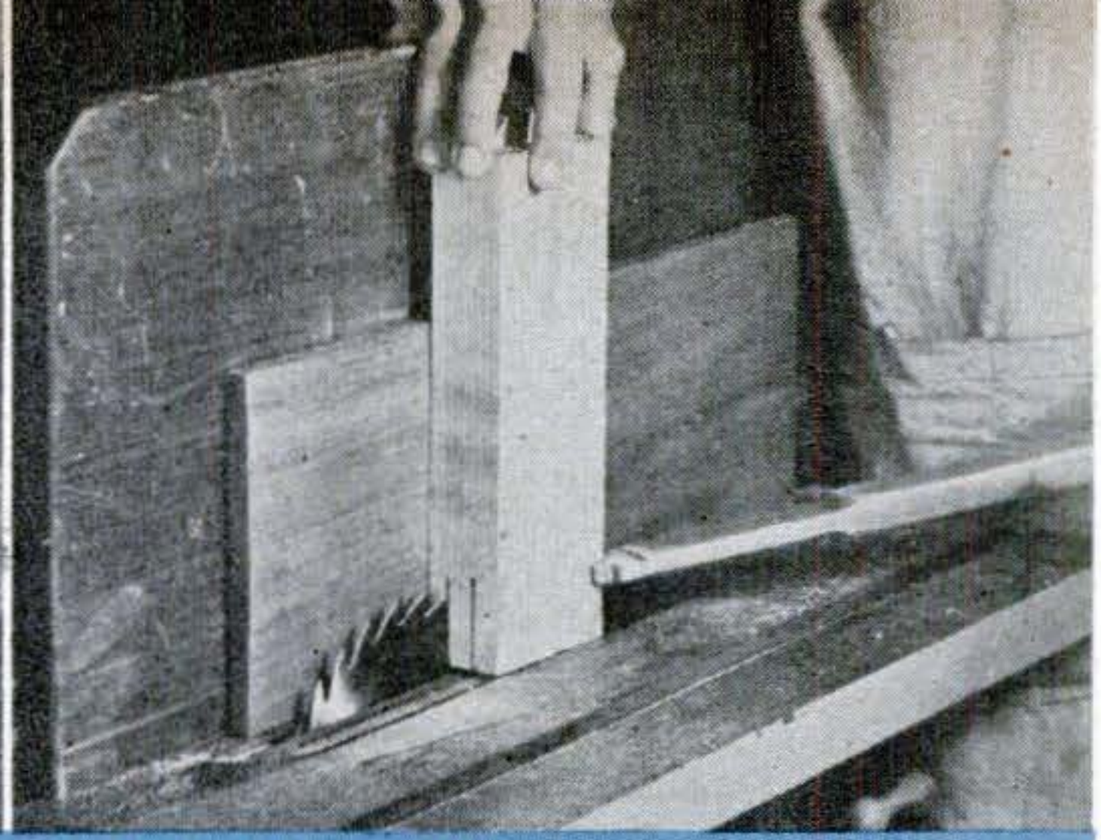
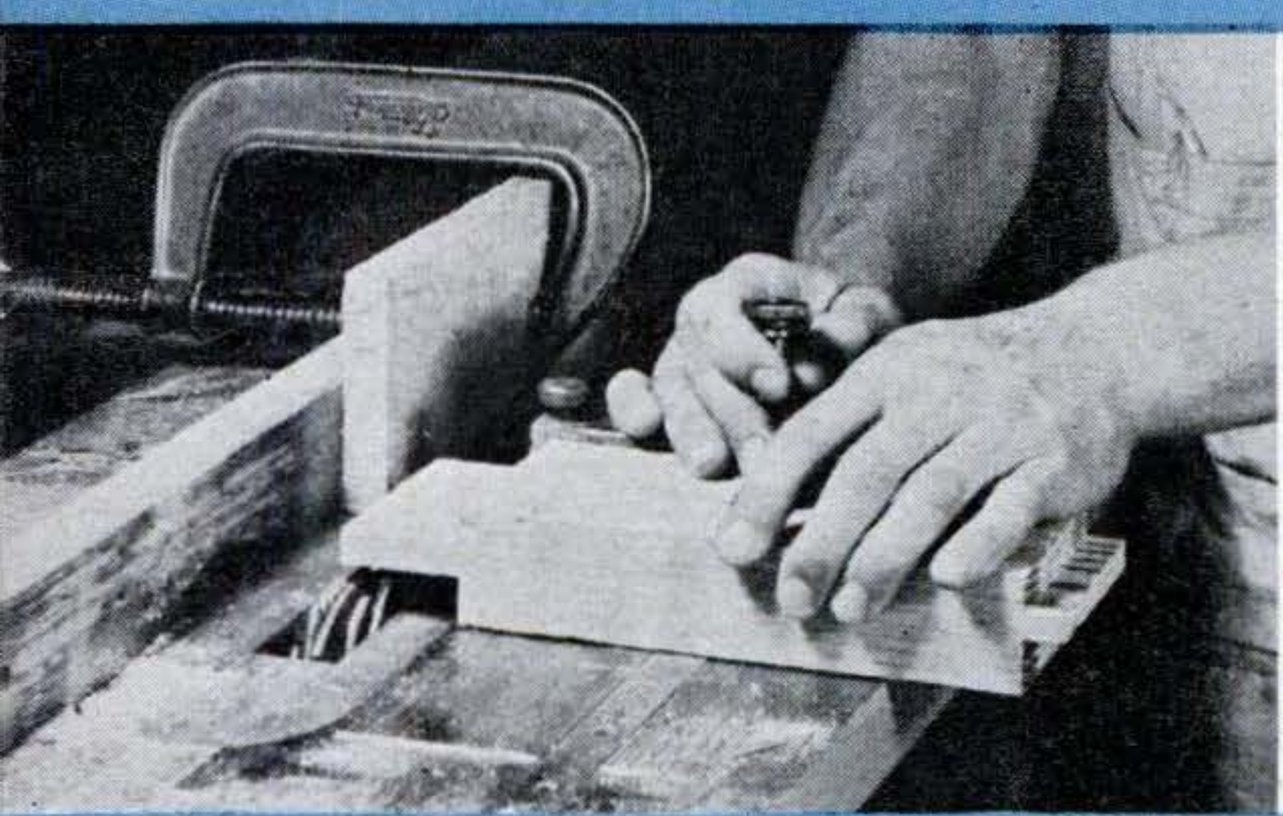
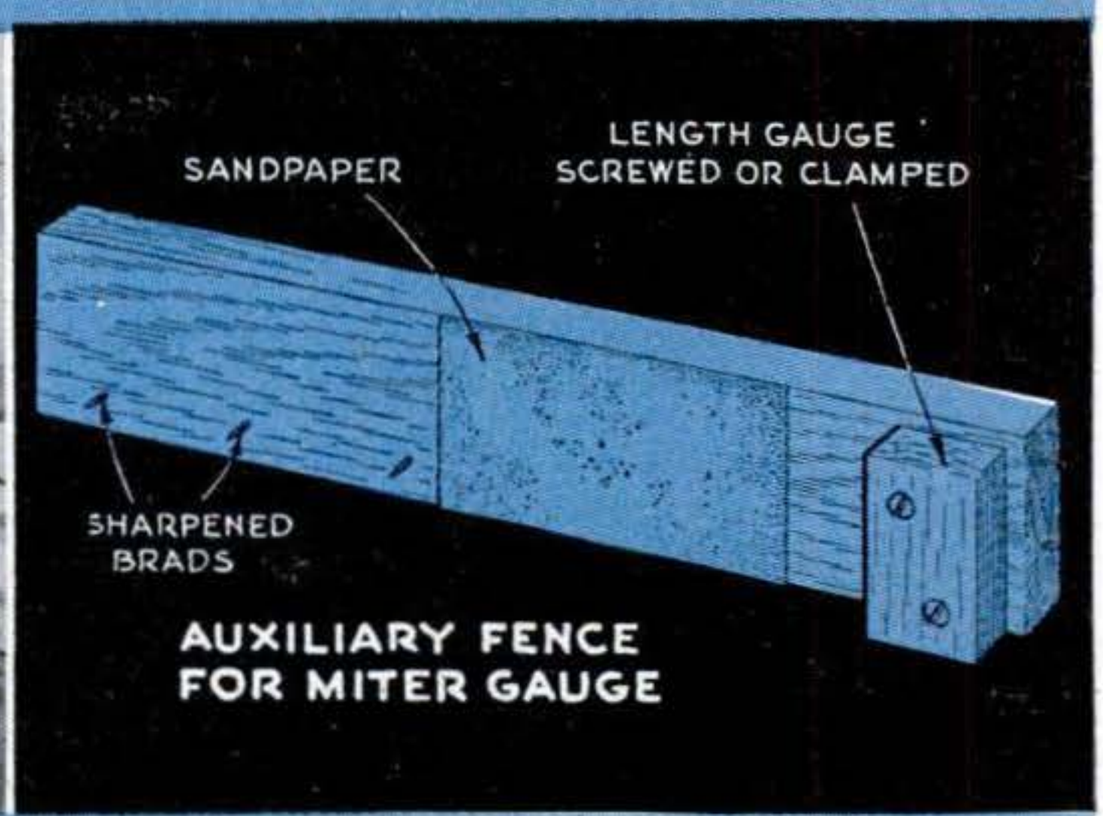
2. Space two blades to rip both cheeks. Tenons will be uniform even though the lumber isn't.



3. Or you can cut the far cheek and insert a shim of tenon thickness to saw the near one.



5. Cutting cheeks with a dado head. Make the shoulder pass first, then work toward the end.



6. A wooden miter-gauge fence faced with brads or sandpaper will hold the work still.

necessary. With a push stick against the following edge, propel the work into the blade while holding it firmly against the fence (Fig. 1). Cut the other cheek to the same measure by sliding the other face against the fence. Make sure that the work rests squarely against the fence and that the push stick has a notched edge that can't slip off. Hooking the little finger of the right hand over the auxiliary fence—as shown—is an extra precaution that should be taken wherever possible.

Power tools being what they are, you can double up on cheek cutting by using two blades and spacing them with washers the thickness of the tenon. A single pass of the work with the face side against the fence cuts both cheeks, as in Fig. 2.

For speed alone the difference between methods 1 and 2 would be so slight as to be hardly worth while, but the double saw has a decided advantage where the lumber varies in thickness or where the tenon is off center. Note that the photo shows unequal cheeks. Regardless of variations in the cheeks or in the lumber itself, all tenons cut with the same setting will be identical.

Another, less speedy method for cutting cheeks of different thickness is to do one side first on all pieces. Reset the fence and do the second cheek with the same face bearing against the fence. Or, you may cut the far cheek, as in Fig. 3 and insert a wooden spacer of tenon thickness between the fence and the work to shift the piece for the second cut.

One way to cut shoulders is pictured in Fig. 4. Gauge the tenon length by hooking the miter gauge rod over the far end or shoulder (assuming that the piece is cut to exact length). Set the height of the saw to enter about half way into the ripped kerf so that it will sever the shoulder without digging into the tenon.

Tenon length can also be gauged by clamping a block against the fence as shown in Fig. 5. Place it ahead of the blades so that the work is clear of it when passing over the cutters. This will prevent the waste piece from jamming between the block and

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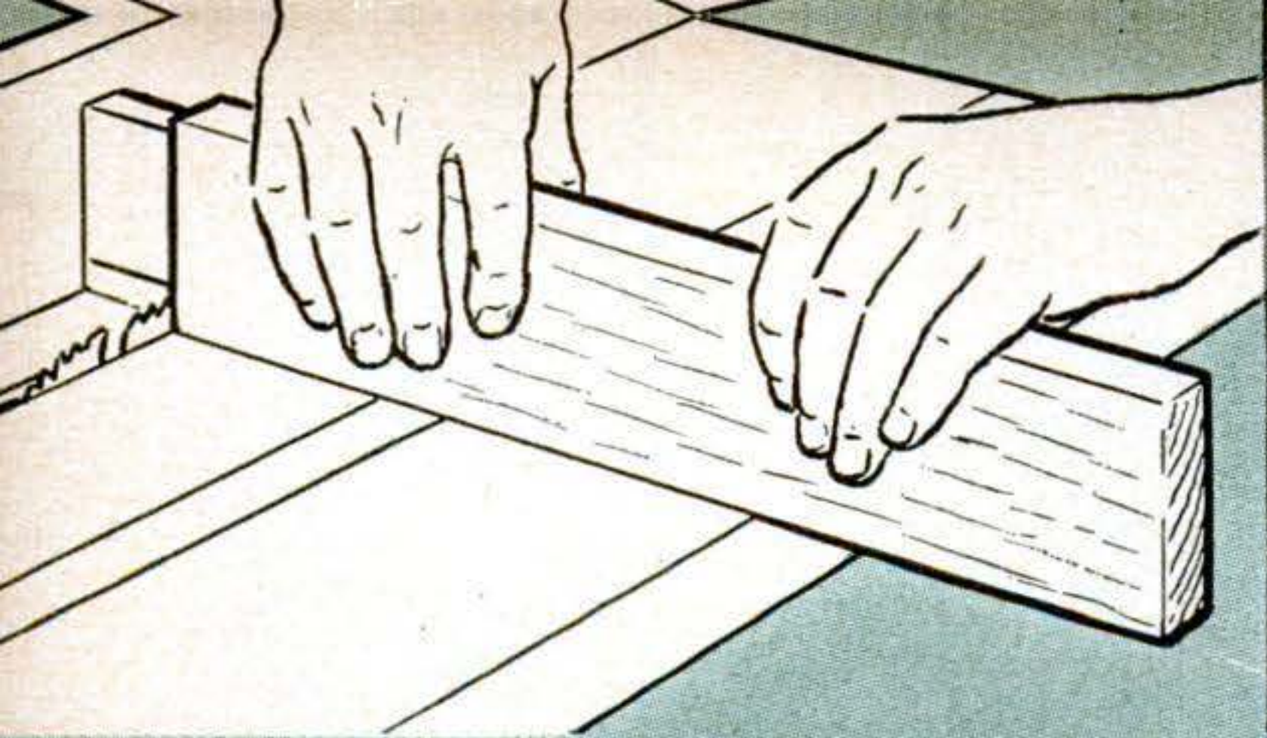


7. After the face stock is removed, rip the edge cheeks and shoulder the edges as shown.

8. To use the jointer for tenoning, lower the table enough to remove the waste in one pass.

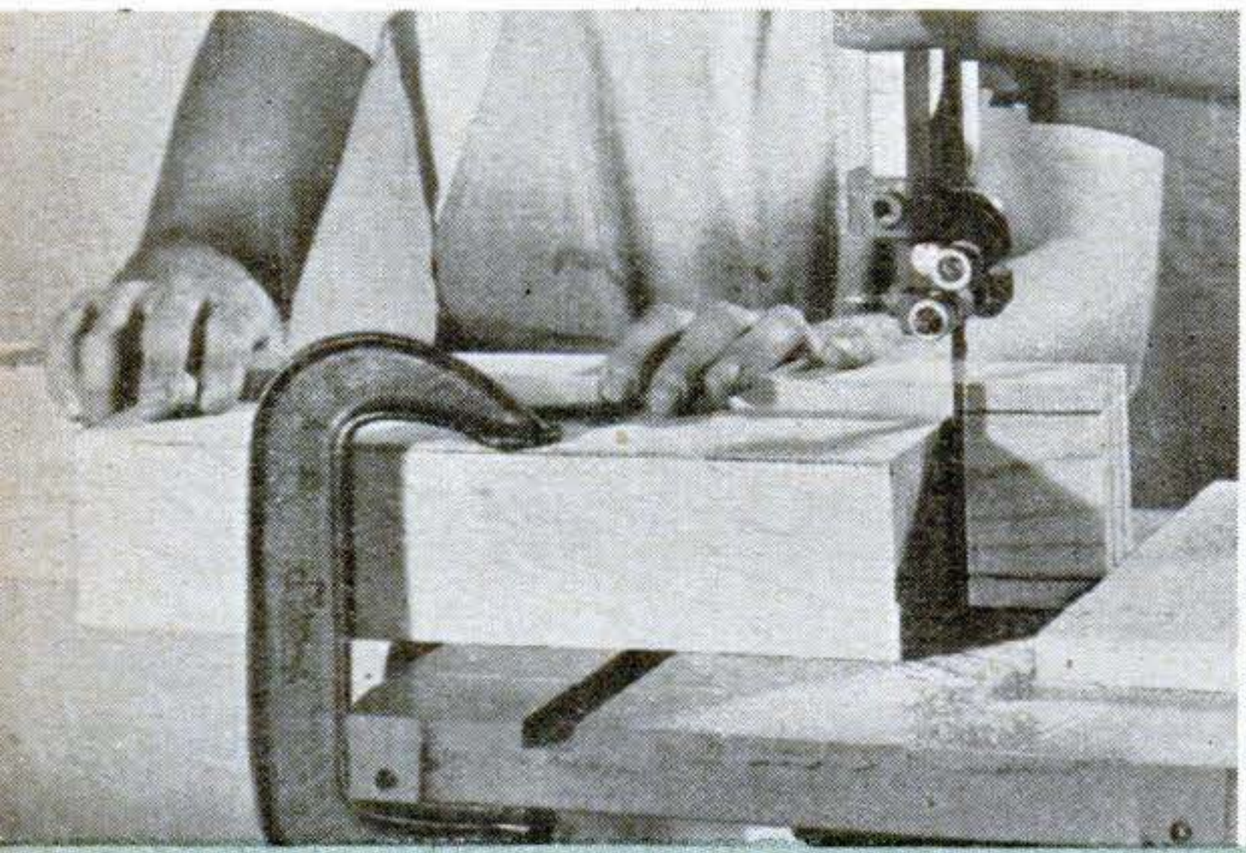
the blades as the shoulder is severed. Since the work will not bear either on the fence or the block during the actual sawing, it must be held firmly in position with the miter gauge. Sharpened brads driven into a wooden strip screwed to the miter-gauge head will prevent creeping. Or, if the small pricks in the edge are objectionable, coarse sandpaper glued to this auxiliary fence will do the trick (Fig. 6). The auxiliary fence is useful either in sawing the shoulder, or, as in Fig. 5, using a dado head. For the latter the cheek cut is not required. Make the shoulder pass first and then work toward the end to finish the job. This is a good method for making long tenons.

Cheek cuts on the edges can be made by carefully duplicating the setup of Fig. 1 but with the edge of the work bearing against the high ripping fence. Edge shoulders can then be sawed by sliding the end against the fence as in Fig. 7. If the face stock has been removed, this operation can often be done freehand, although a miter gauge would insure accuracy.

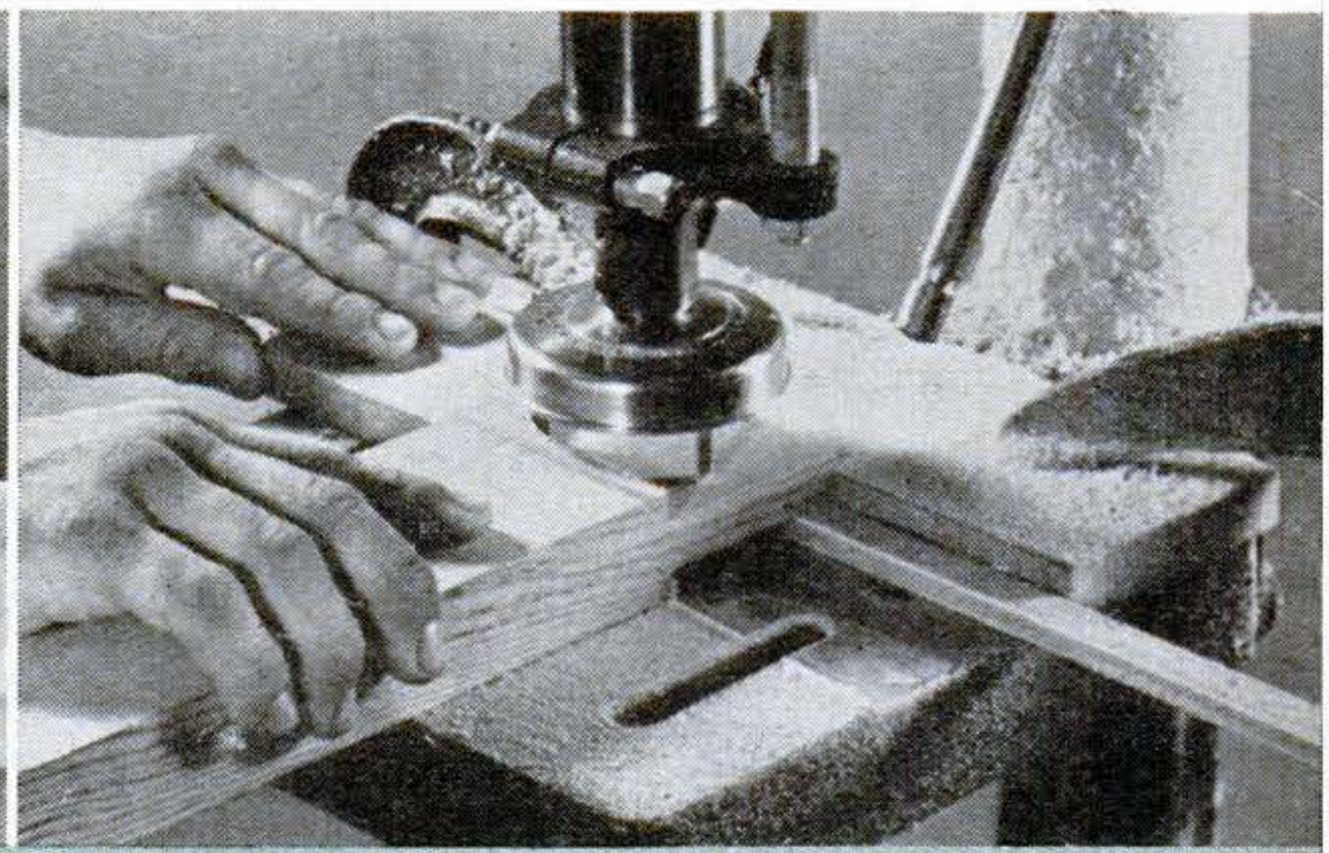
A jointer used in a simple rabbeting operation (Fig. 8) is an effective tenon maker. Lower the table enough to remove the waste in one pass and slide the end against the fence. Unless the blades are very sharp, they may splinter the shoulders, so it's wise to saw these first. Do not attempt narrow tenons on a jointer except in a holding jig.

One pass on a shaper cuts stub tenons on both sides as shown in Fig. 9. Mount a couple of straight-edge cutters on the spindle with a washer between to space them for tenon thickness. The clamp shown on the miter gauge helps prevent the cutters from forcing back the work, but a block screwed or clamped to an auxiliary miter fence (Fig. 6) would also serve.

In an operation that resembles resawing —making several thinner pieces out of a thick one—the bandsaw can be used effectively for making long and wide tenons.



11. Shoulders are bandsawed after cutting cheeks and edges. Block at right gauges length.



12. A rotary planer in a drill press does an accurate cutting job on the faces of a tenon.

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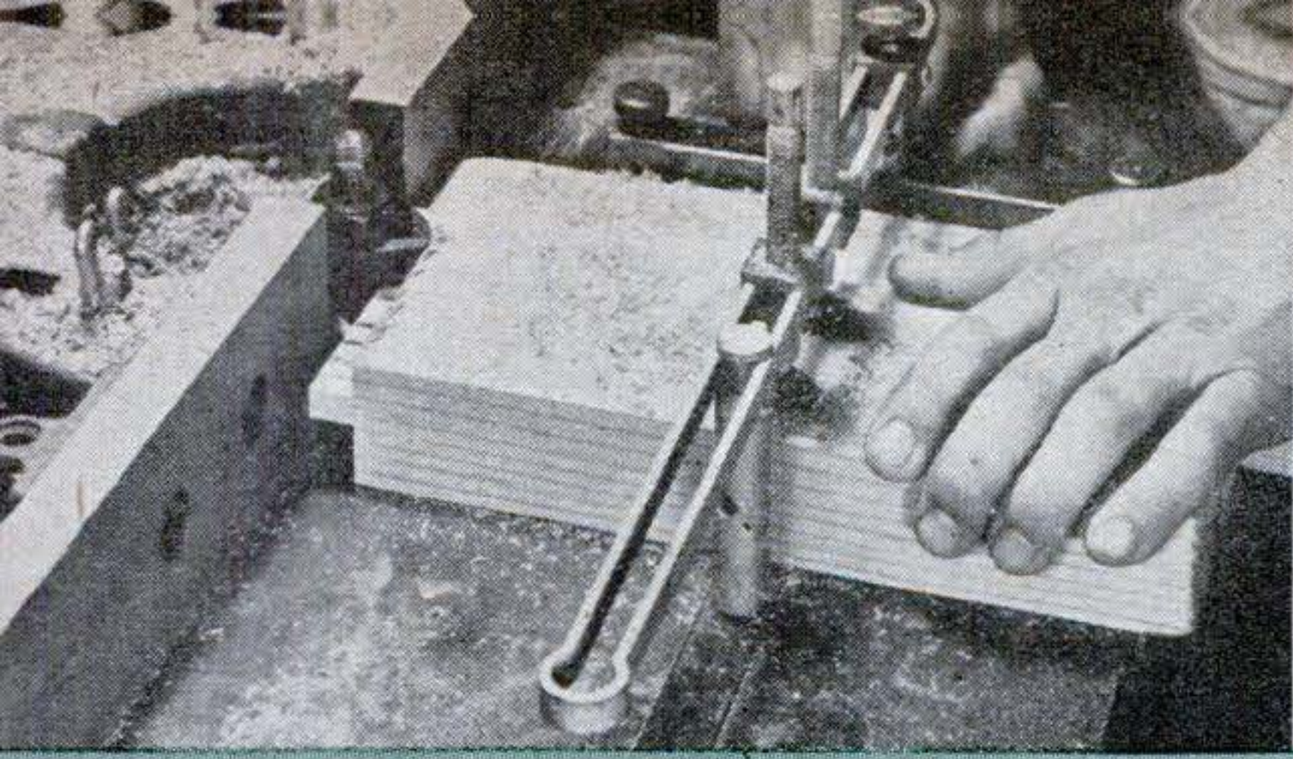
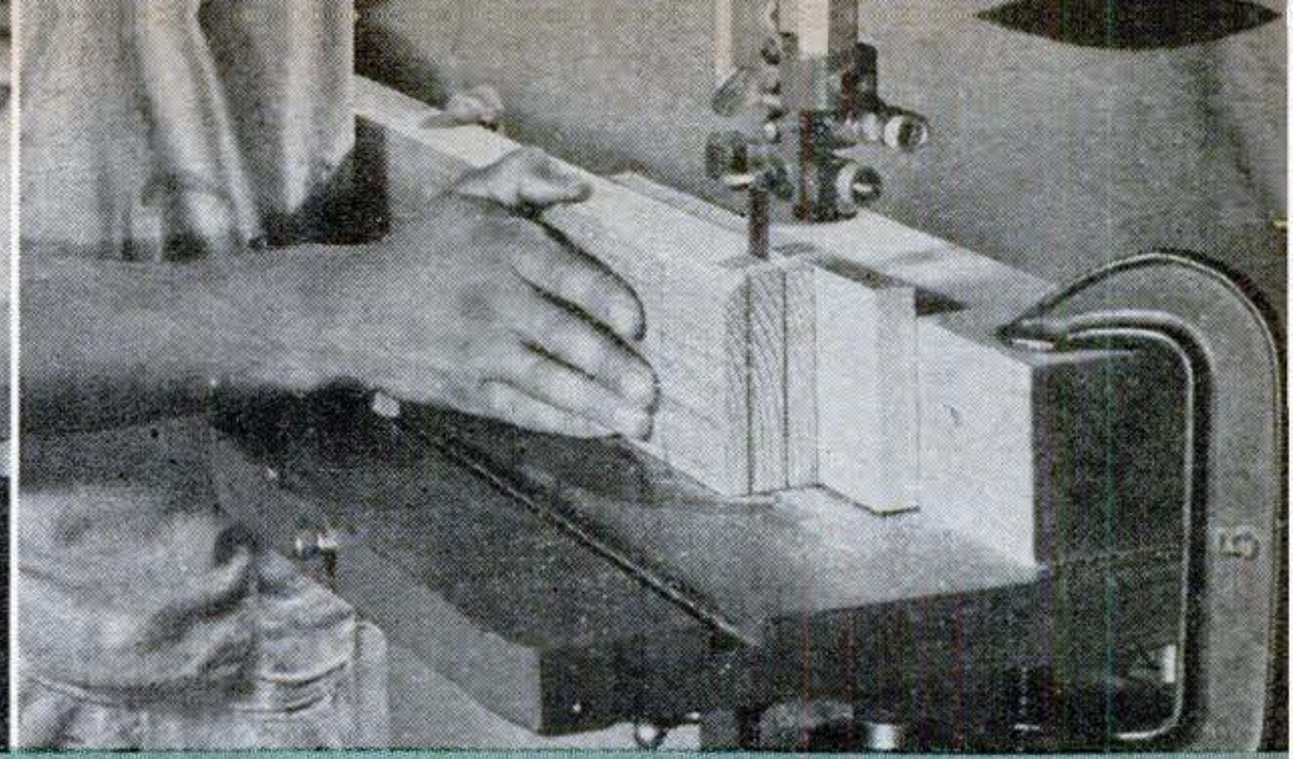


9. Stub tenons are easily made on a shaper. Use two straight cutters spaced by a washer.



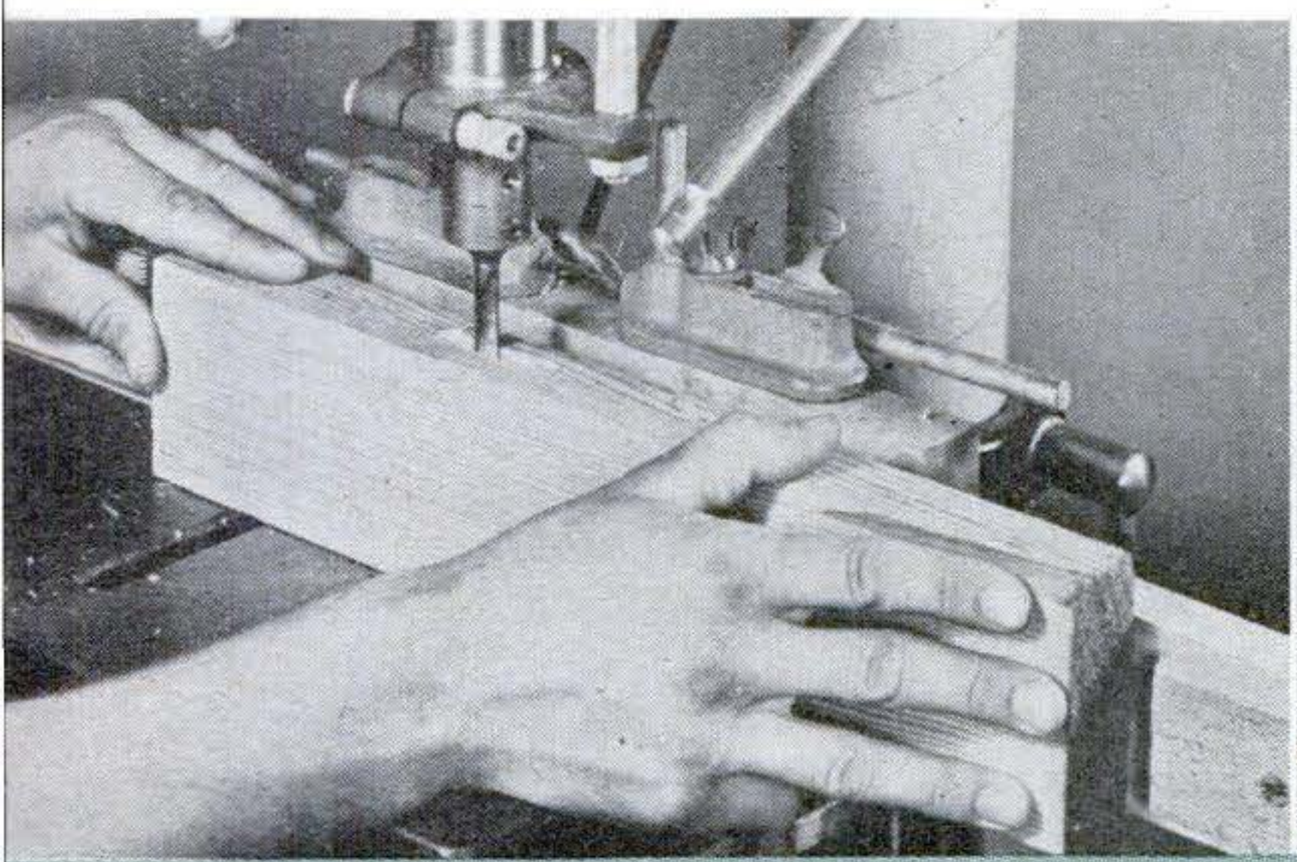
10. A bandsaw is especially good for long and wide tenons. The job is similar to resawing.

Clamp a fence block to the table to guide the cheek cut. Take into account the lead of the blade. A test cut helps to determine whether the blade cuts off center, and if so, how much. Rip the cheek, using a pencil mark or stop clamped to the table to establish the length. Saw on the outer or waste side of the line. By using a shim between the fence and the work—Fig. 10—you can make one setting serve for both cheeks. Slide the work sideways against the teeth as in Fig. 11 to cut a shoulder. A jigsaw can be used in similar setups.

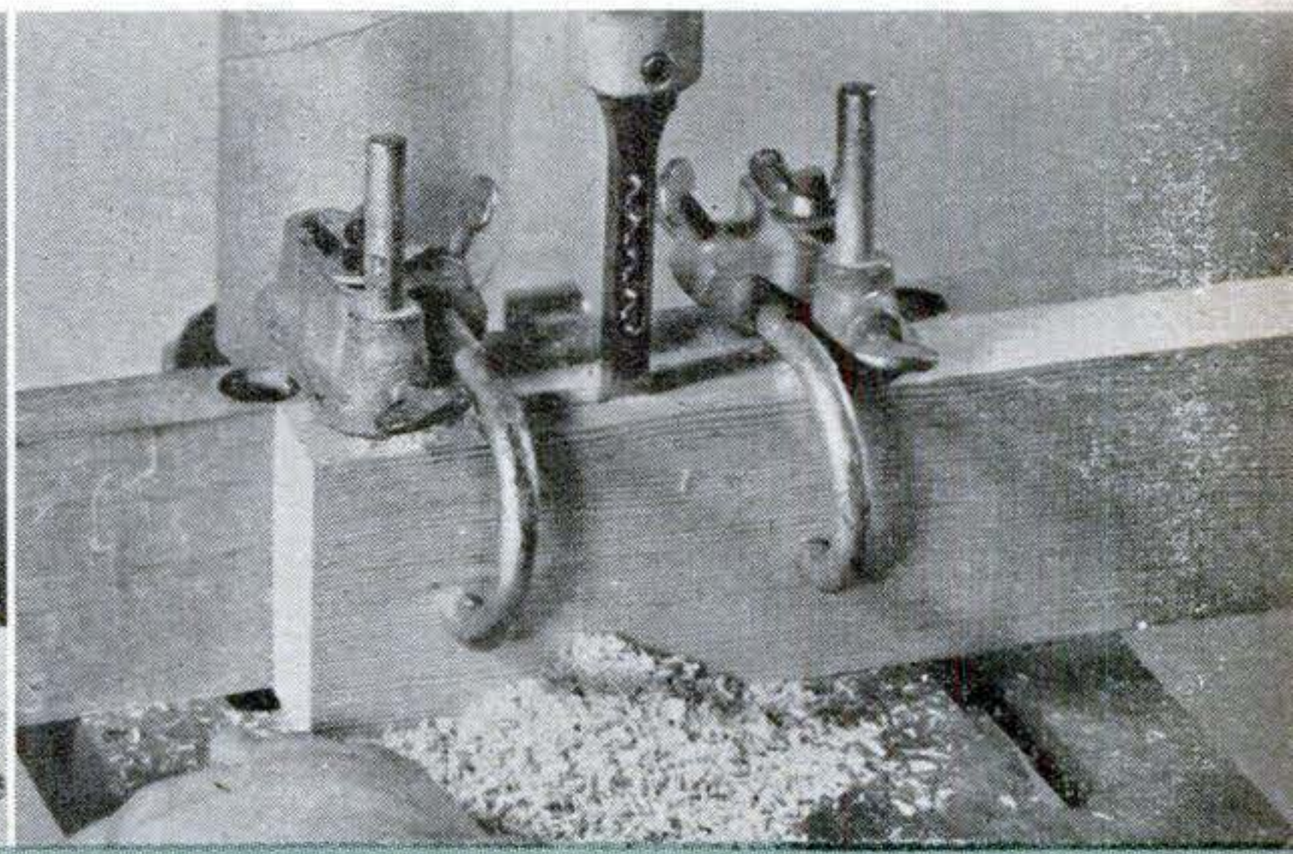
You can depend on a rotary planer in a drill press to turn out precision tenons. The technique, pictured in Fig. 12, is the same as for edge rabbeting except that the work is turned over to do the second side. As with all tenons, the critical dimensions are the thickness and the distance from the face of the stock. Test cuts in scrap are advisable, especially when the tenon is off center. A support should be used under the work for rigidity when planing the second side.

The drill press is the one ordinary shop machine adapted to making deep mortises. Lacking special equipment, you can make a series of holes and finish with hand chiseling as described last month. Or, as in Fig. 13, you can substitute a router bit for a regular one and slide the work under it from left to right. Move the piece only in this direction, and make successive cuts until the proper depth is reached. Note the blocks clamped to the fence to locate the starting and stopping points. You can either square the mortise ends with a chisel or round the edges of the tenon to fit.

Mortising chisels (Fig. 14) produce square-end mortises in quick order. These square trimming chisels are cored with revolving bits that lift out the bulk of the wood. The first cut is snug, requiring plenty of lift to withdraw it—which is the reason for the hold-downs in the photo. Later cuts take less pressure. END



13. A router bit can be used for mortises of any length or depth. Chisel the ends square.



14. Mortising chisels make clean, square-end mortises in rapid order. Use hold-down clamps.

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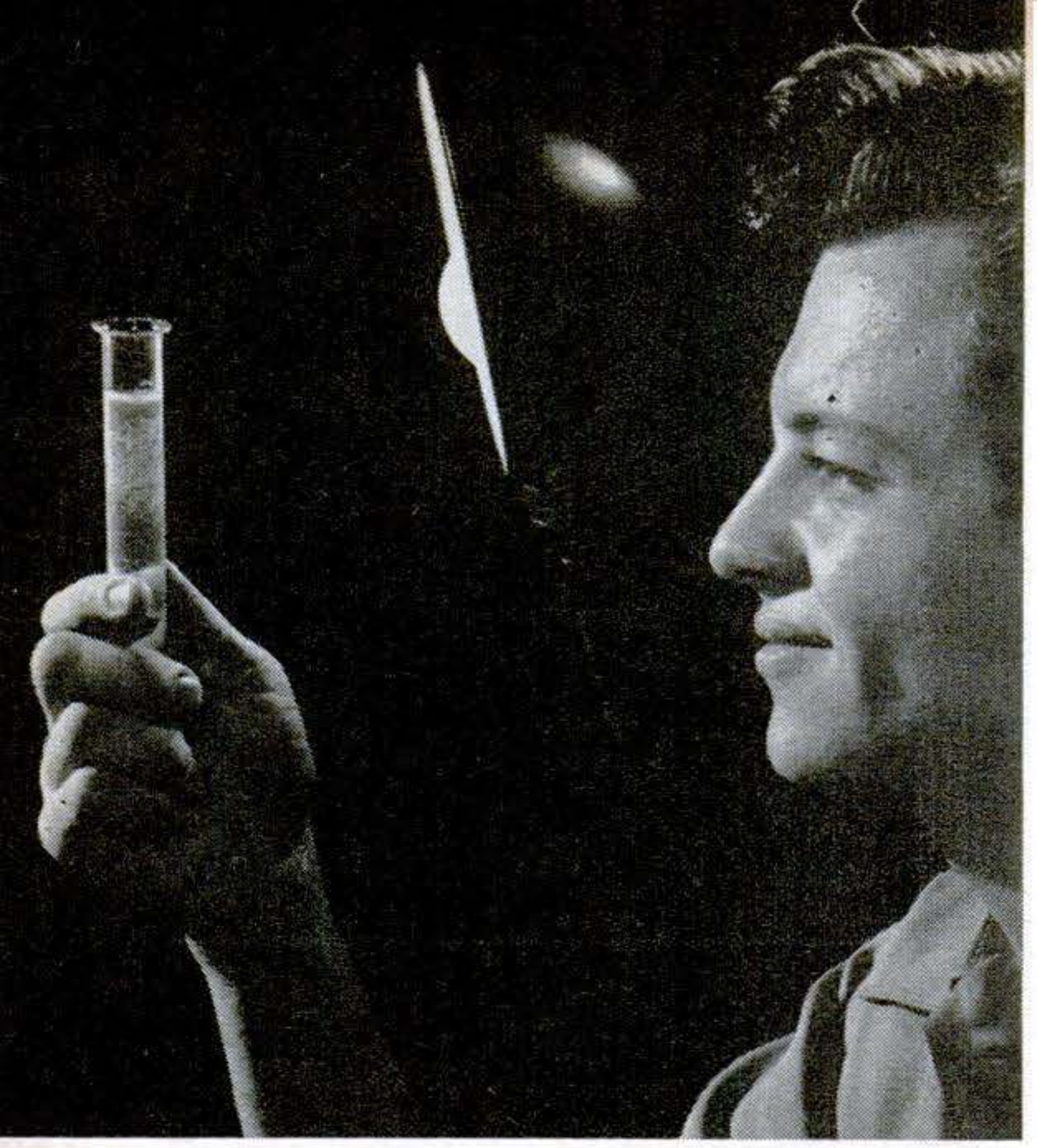

Experimenting with Cold Light

Color May Change. Many substances fluoresce beautifully when viewed by a small argon bulb or a regular ultraviolet lamp. Fluorescein is one of these. Dissolve just a speck of this dye in a test tube of water containing a little lye (sodium hydroxide). Look through this solution toward the light and it will appear orange-red, its normal color. Reflect light from the surface facing you, however, as here shown, and the substance fluoresces bright green.

COLD light is exactly what you might think it is—light without noticeable heat. A firefly and fluorescent lamp are common sources.

Such light is still imperfectly understood by science. Fireflies produce it through biochemical action. Fluorescence is thought to result from molecular disturbance. Here, light of one color is given off when a substance comes under light of another color.

In common terms, a substance is said to be fluorescent when it produces light only while being acted upon by light. If it glows without light acting upon it, or after the light has been removed, it's said to be phosphorescent. Some substances may be both.

Light Made Chemically. Light is given off when many chemical substances react with each other. Usually, nascent, or "new-born," oxygen plays a part. Even such things as chili powder, mustard, and paprika may be the source of a feeble light.

When properly treated, oil of bergamot will give off quite a strong light. Get a little of this at a drug store. Add about ¼ teaspoon to ½ oz. of denatured alcohol or ethyl rubbing alcohol in which a pea-sized piece of lye has been dissolved. Now add ¼ teaspoon of hydrogen peroxide and an equal amount of sodium hypochlorite solution. Take the test tube immediately into a dark room and you will find it glows coldly.

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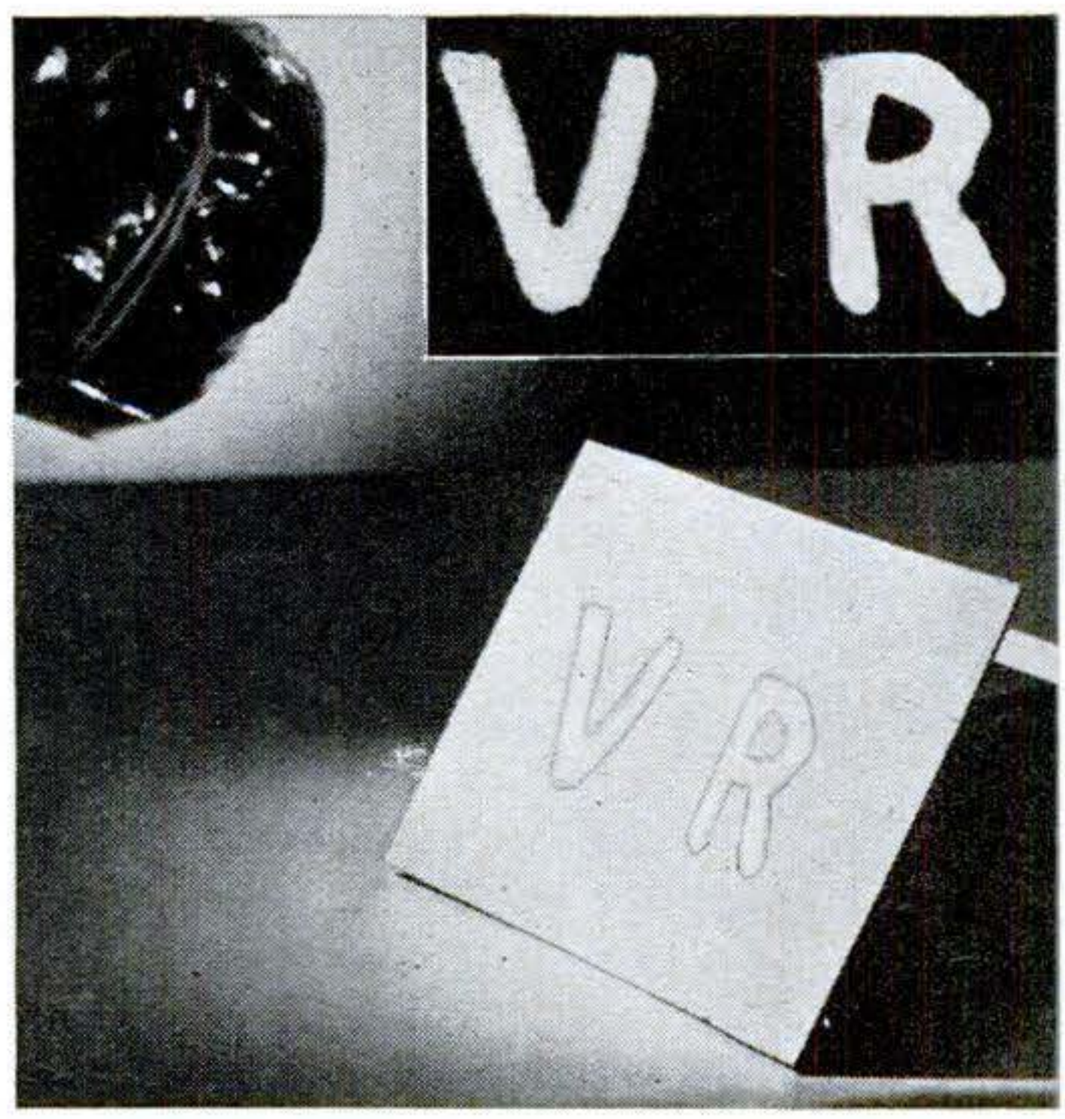
Magic Paint Glows. You can make a phosphorescent paint that will glow in the dark without any initial illumination. Using tongs, cut off a tiny piece of phosphorus under water. Dissolve in 1″ of carbon disulphide in a test tube. Add 1″ of olive oil and shake gently. Keep away from flame.

Paint letters with this on heavy cardboard and the word will shine in the dark. Immerse the brush in water immediately after use, and later clean in carbon disulphide and finally alcohol. Dispose of the solution.

Wave Lengths Play Tricks. One early experimenter with fluorescence made the discovery that no fluorescent substance will glow if acted upon by light of longer wave length than that which it gives out.

Get samples of two fluorescent paints that are also phosphorescent. Violet and red are a good color choice. Paint a letter with each on cardboard, expose to a flashlight for a minute in a dark room, and then turn off the light. Because the beam of the flash contains short wave lengths, right down to the ultraviolet, both letters will shine (inset).

Now allow the residual light of the letters to die. Cover the flash with several thicknesses of yellow or orange cellulose plastic, and shine its beam once more on the letters. This time, after the light has been turned out, only the red letter will glow.



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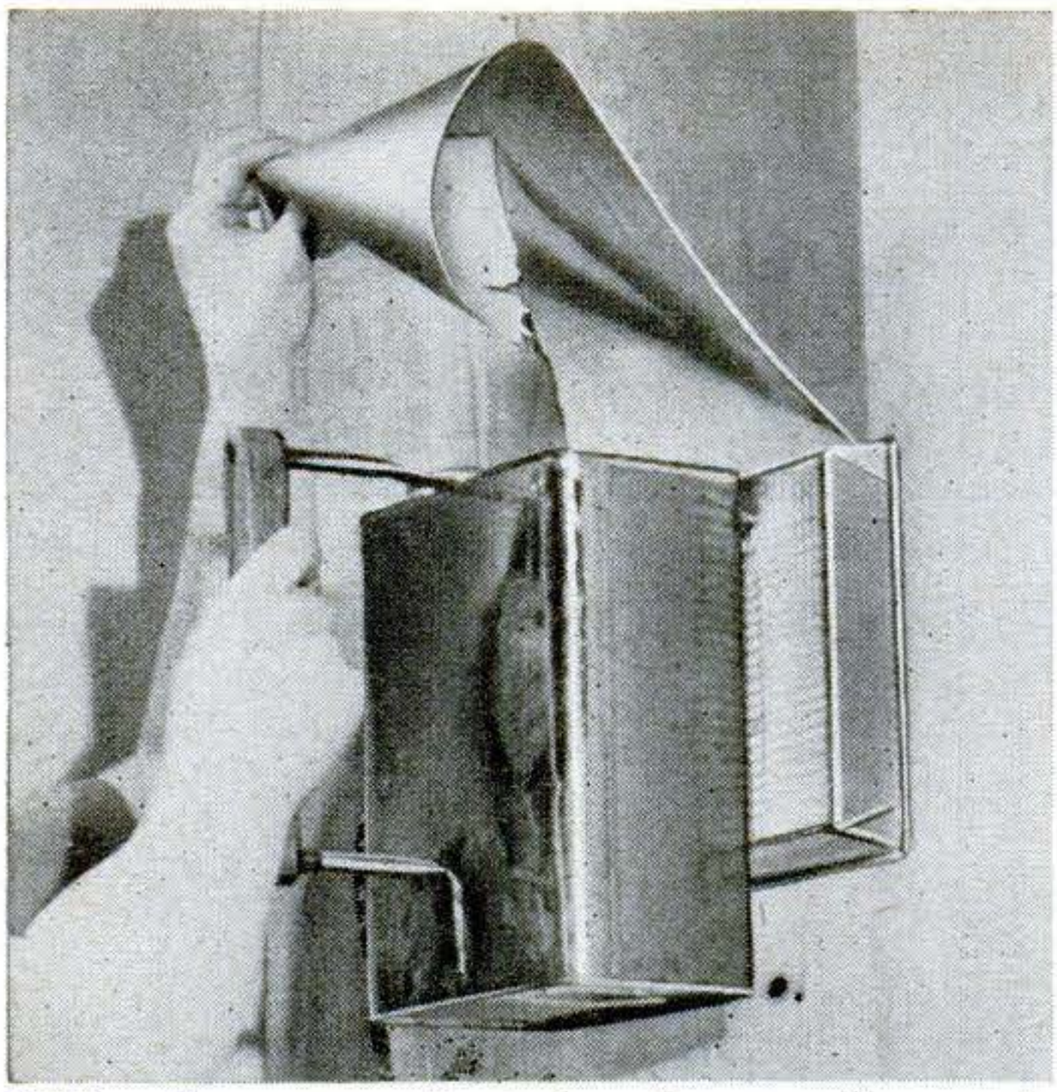
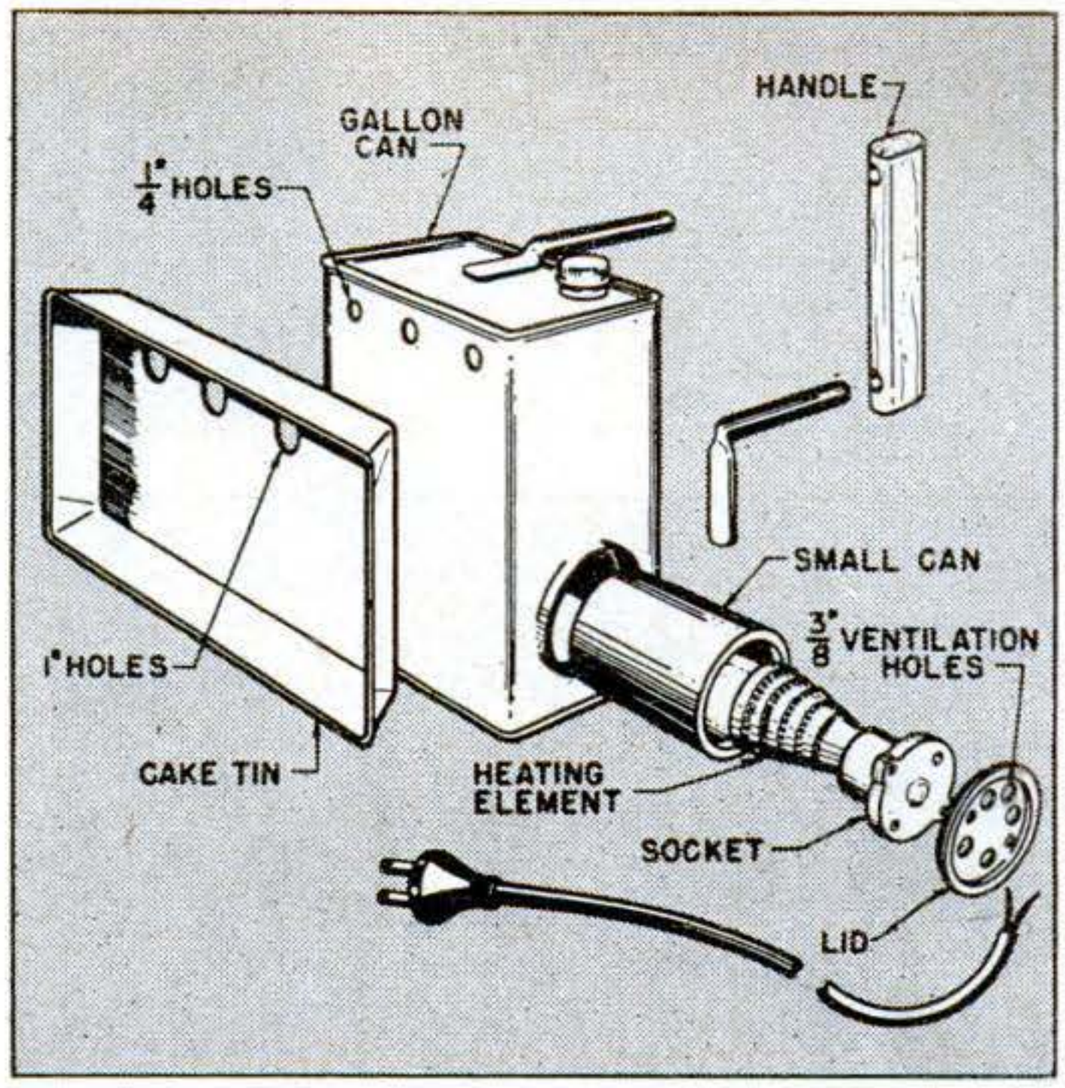




Old wallpaper peels right off as it is loosened. Half fill the boiler, plug in the cord, and when steam is up, move the steamer slowly over the wall. The drawing above shows construction.

Electric Steamer Removes Wallpaper

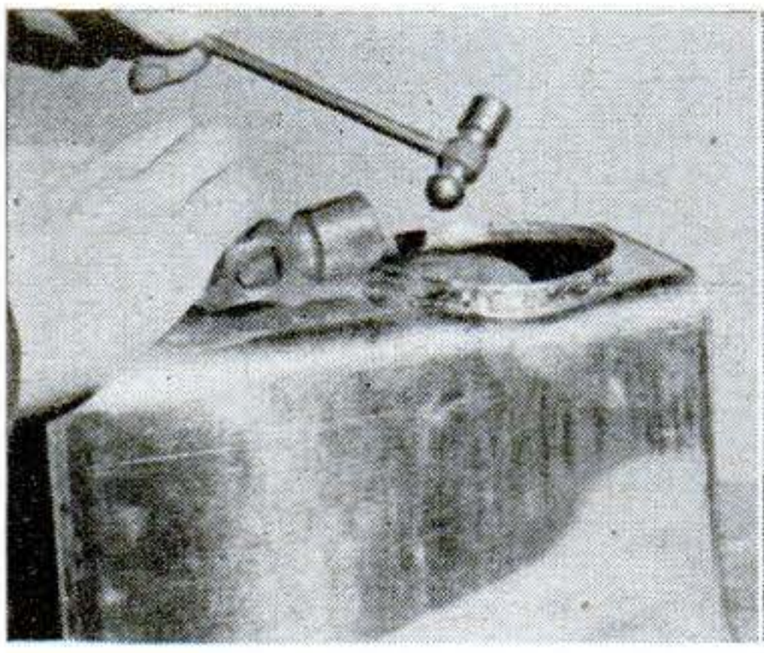
REMOVING old wallpaper is almost as easy as peeling a ripe banana when you slide this steamer over the wall. It's a big timesaver on your Spring repapering job, and if the walls are plaster there's little chance of gouging them as you might with a scraper.

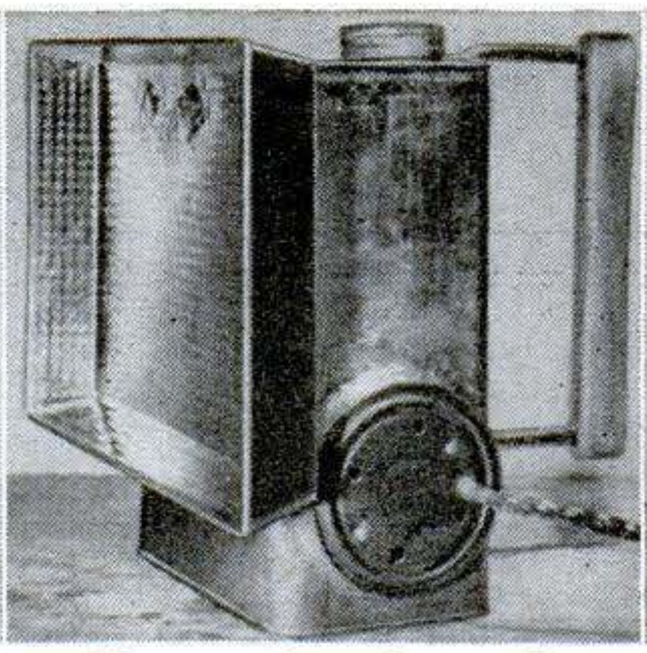
Here's what you need: a gallon can for the boiler, a cake tin for the steam chamber, and a can for the heating chamber. The latter should allow ½" clearance inside for a 600-watt heating element, in a porcelain socket.

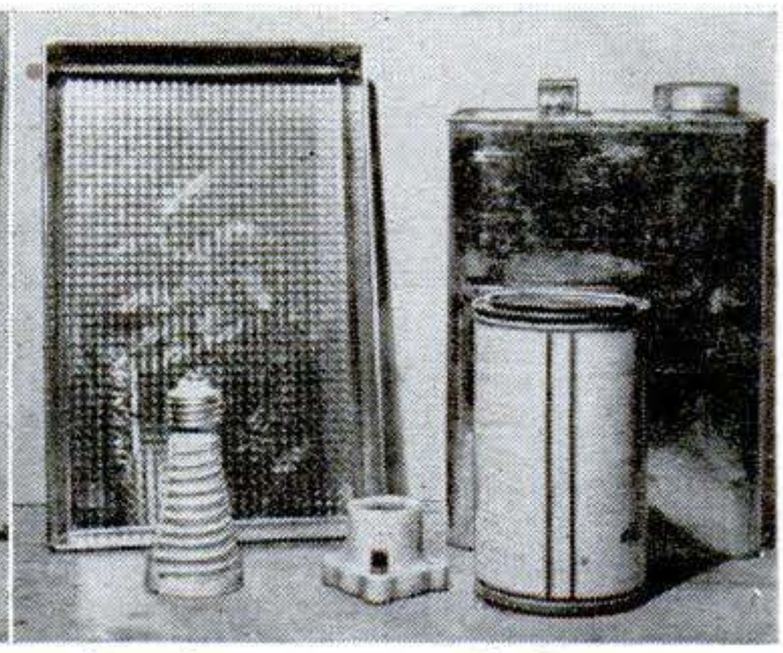
Cut a hole in a narrow side of the boiler ½" from the bottom. Make the hole ½" smaller in diameter than the small can. Around this hole, turn up a ¼" lip and carefully solder the heating chamber to it. Then fill the boiler and let it stand to see if the joint is watertight. Meanwhile, bolt the socket to the inside of the small can lid.

Next drill the three ¼" holes ½" from the top of the boiler to allow steam to enter the steam chamber. Then drill or punch three 1" diameter holes in the cake tin that register with the ¼" holes in the boiler. The 1" holes expose plenty of boiler surface for you to solder on the cake tin. Copper tubes, soldered to the boiler, hold the wooden handle.

Don't fill the boiler while the cord is plugged in, and don't let the water level get too low.—*James A. Richards, Saco, Me.*







With a hammer, turn up a ¼" lip all around the hole in the side of the boiler. The heating chamber is soldered to the lip. Center photo shows the completed steamer ready for use. At right are the five principal parts of the steamer. Other parts are electric cord and handle.

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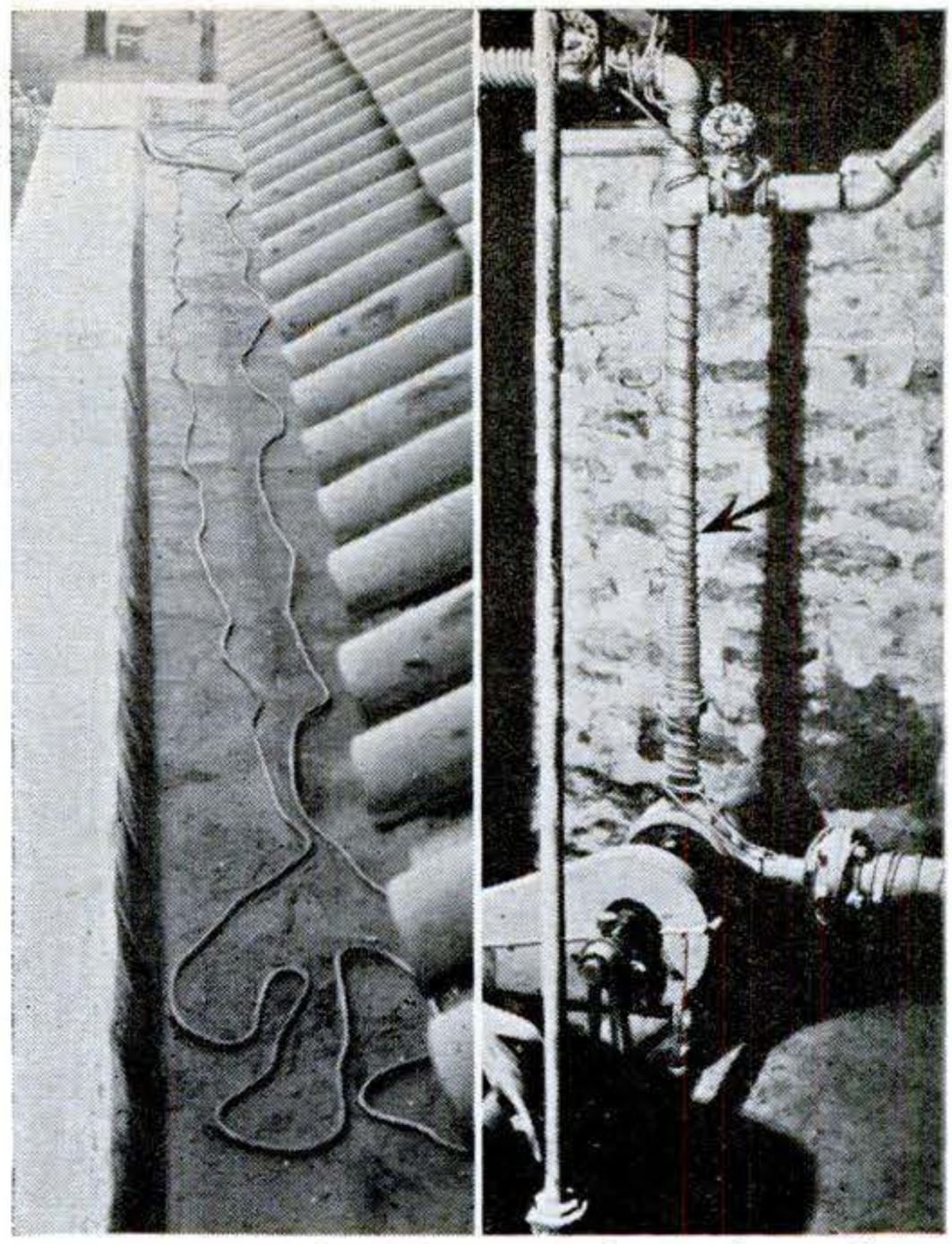
Electric Cable Melts Ice and Snow

HEATING cable, developed for hotbeds, is finding a variety of other uses. Buried in concrete, it'll keep sidewalks and driveways clear of ice and snow; wrapped around pipes it prevents freezing. Some other uses include melting ice in gutters and downspouts of buildings and along the eaves, and heating floors in poultry houses, kennels, and other buildings.

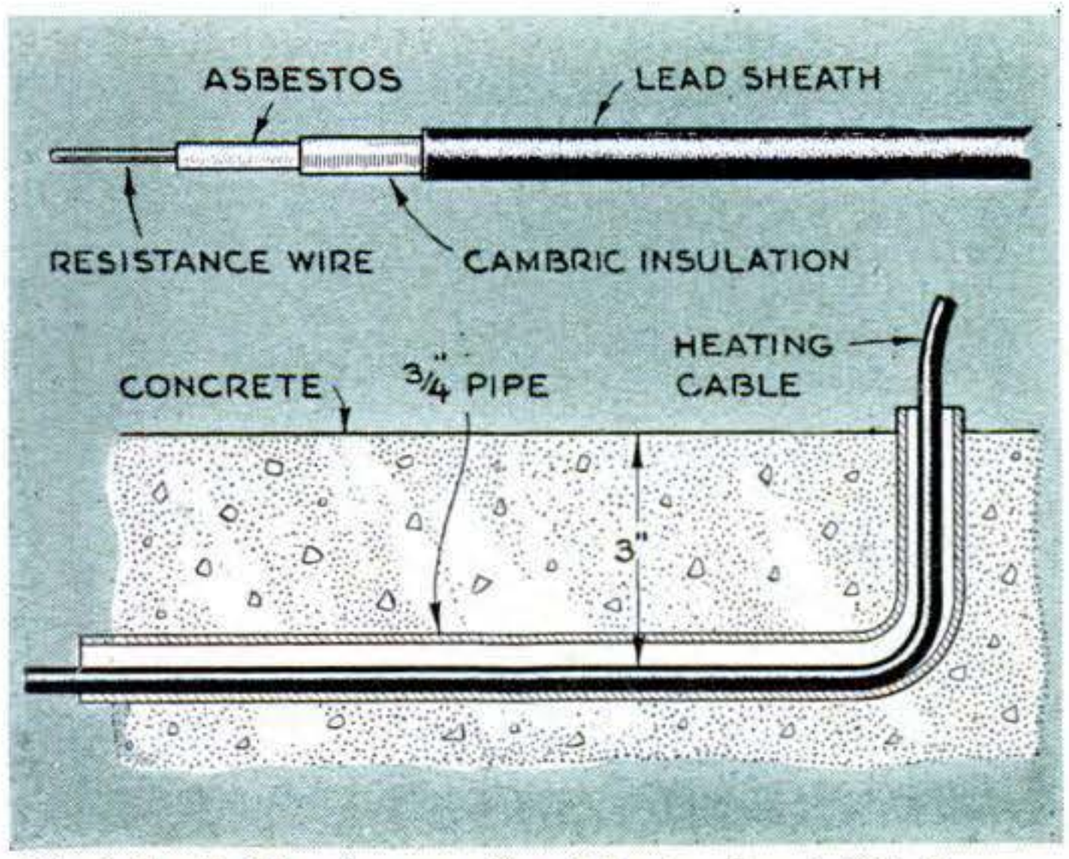
The cable consists of a single conductor of resistance wire in a flexible, waterproof lead sheath. It may be bent to a 2″ circle. It comes in two lengths with both ends in one plug—a 60′ length for 115-volt AC, drawing 400 watts, and a 120′ length for 230-volt AC, rated at 800 watts. Available in other lengths, it has a hot resistance of .53 ohms per foot. Thermostatic controls can be used, or the cable can just be plugged into an outlet. Surface temperature of the sheath is usually about 95 deg. above free air temperature, and it can be safely mounted on boards. However, it should not be used in locations where the sheath will exceed 165 deg.

For driveway snow-removal jobs, the cable is laid in a small-diameter pipe that is buried in the concrete. The pipe protects the lead sheath against the lime in the cement. A homemade setup for keeping snow and ice off steps is shown at the bottom of this page.

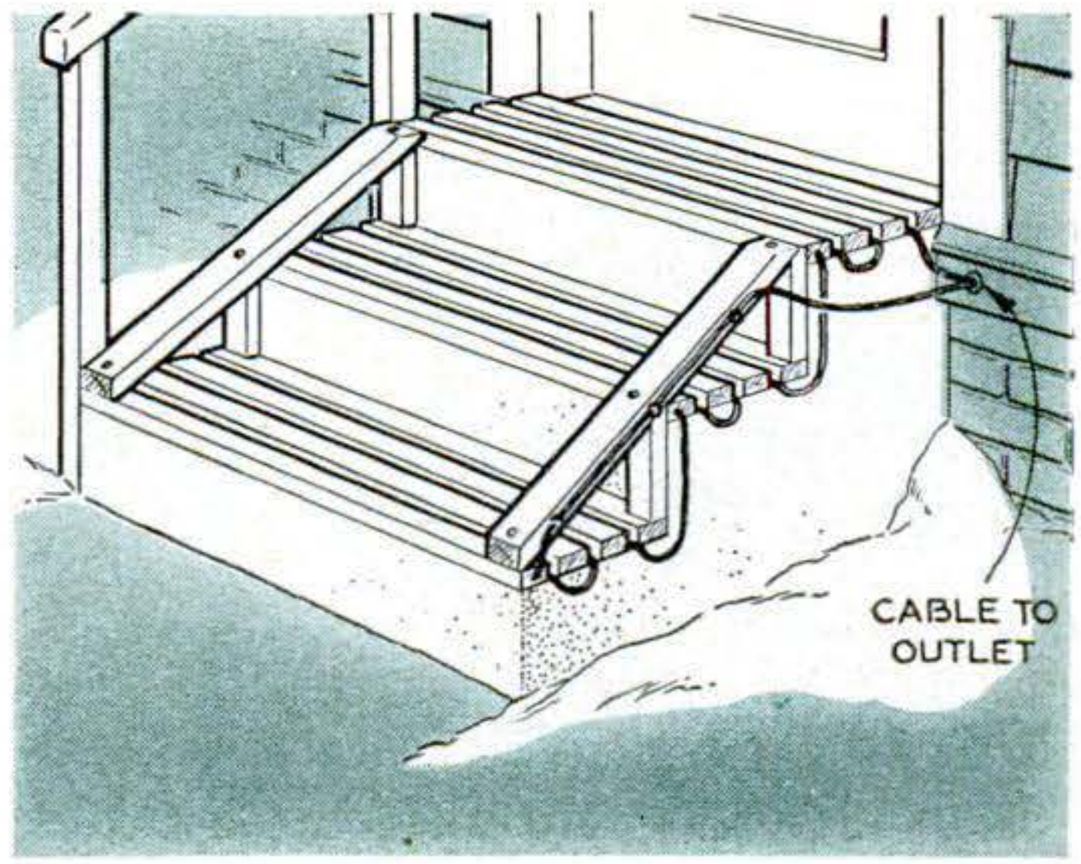


Gutters of a building are kept clear of ice and snow by the cable. A loop of cable is dropped in downspout to keep it open. At right, pipes in unheated cellar are kept from freezing.

This assembled set of double outlet box, thermostat, and cable is made by General Electric.



Finished diameter of cable is about ¼″. Lower drawing shows how cable is laid in concrete.



Snow and ice is melted from steps by cable laid between slats. Staples hold the cable in place.

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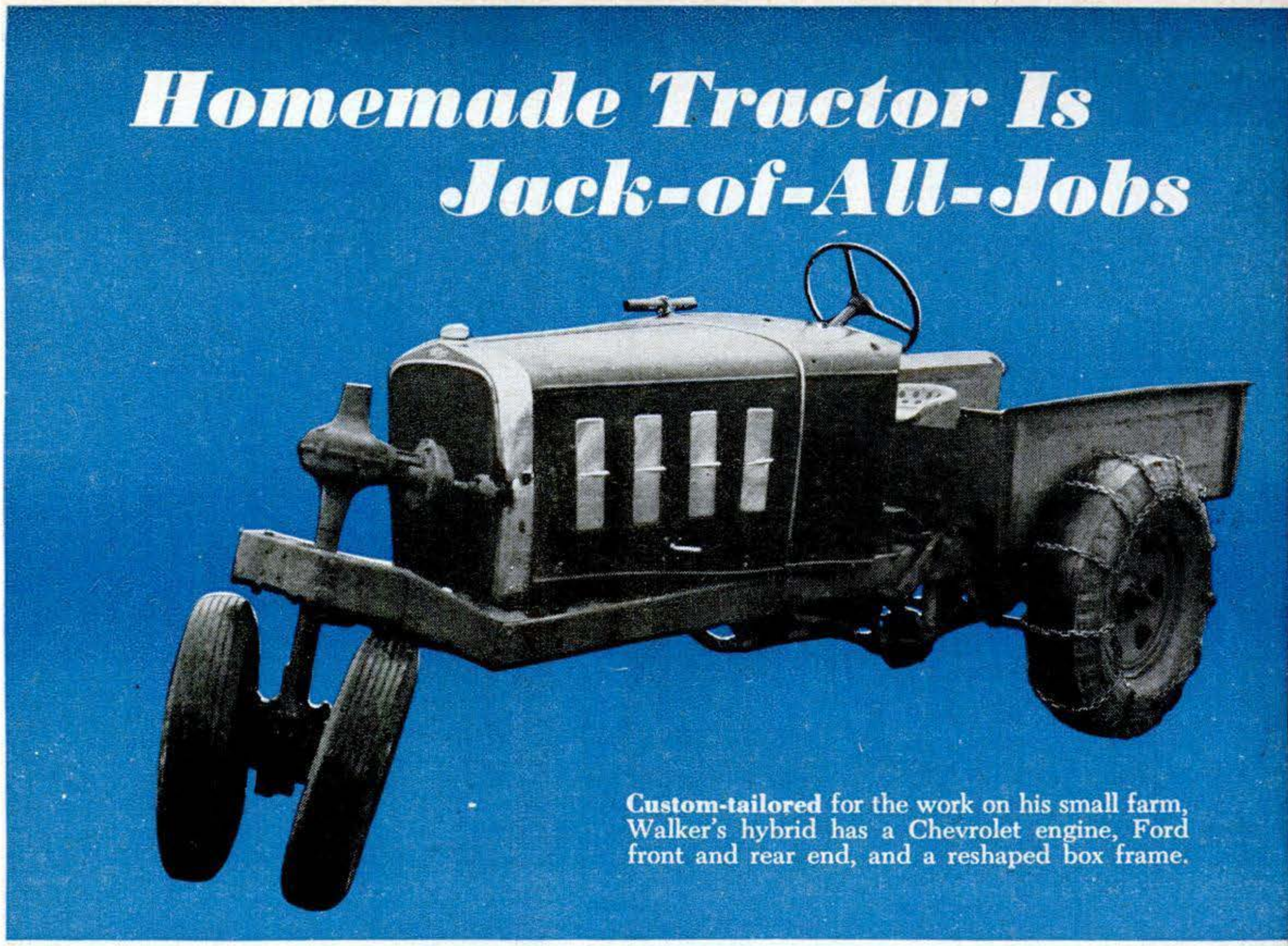
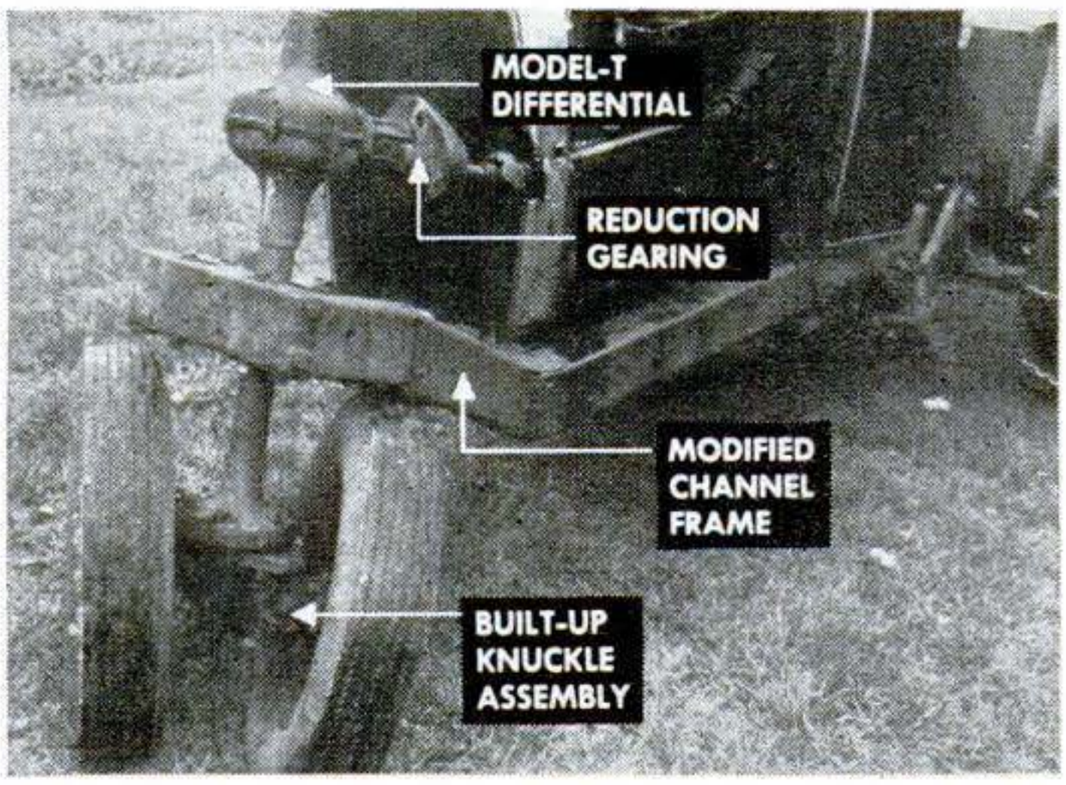
Homemade Tractor Is Jack-of-All-Jobs

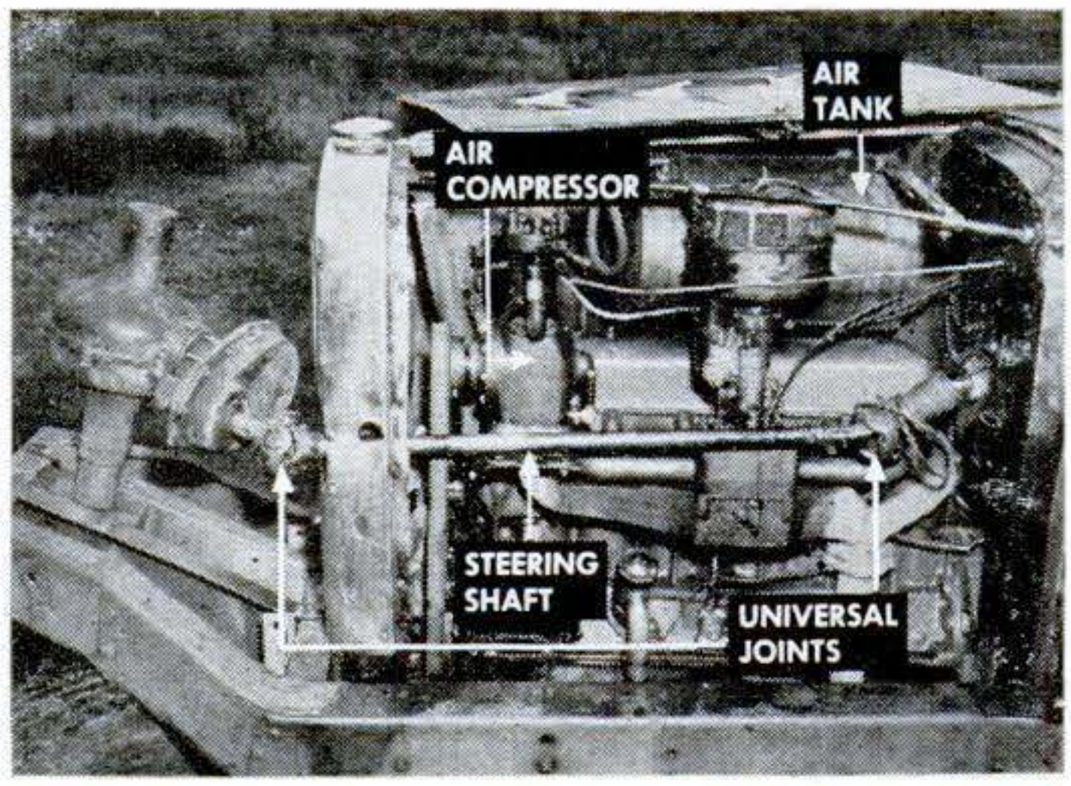


Custom-tailored for the work on his small farm, Walker's hybrid has a Chevrolet engine, Ford front and rear end, and a reshaped box frame.

NO ORDINARY "doodlebug," or superficial auto-tractor conversion, the curious vehicle above is the product of Paul H. Walker, a die-shop foreman of North Oxford, Mass. In his spare time Walker and his wife operate a small farm, and they needed power to make the job easier. The result is this specially tailored hybrid. It draws two plows, either of which can be controlled by an ingenious compressed-air system; it mows efficiently, with the cutter bar extending from the right side of the frame; it serves as a dump truck for numerous farm carrying tasks; and in wintertime it makes short work of snowdrifts on Walker's long driveway. Built without welding equipment, its frame was reshaped with hacksaw and rivets. Walker is also the builder of the "dream car" shown in PS for Nov. '48, pp. 178–180.



Offset chassis gives wheel clearance, and old up-ended differential makes the steering easy.



Belt-driven air compressor, taken from an old refrigerator, can be controlled from the dash.

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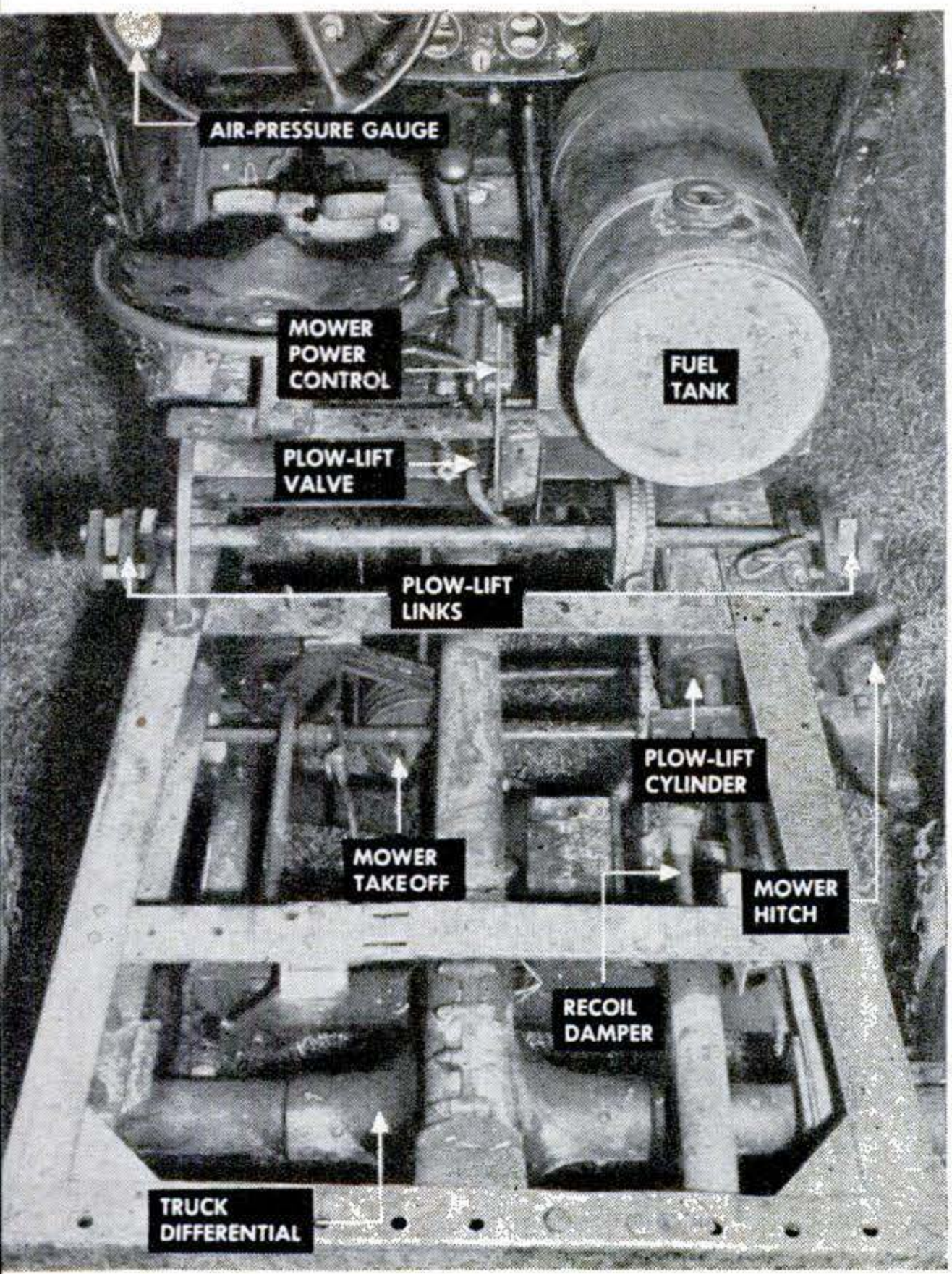
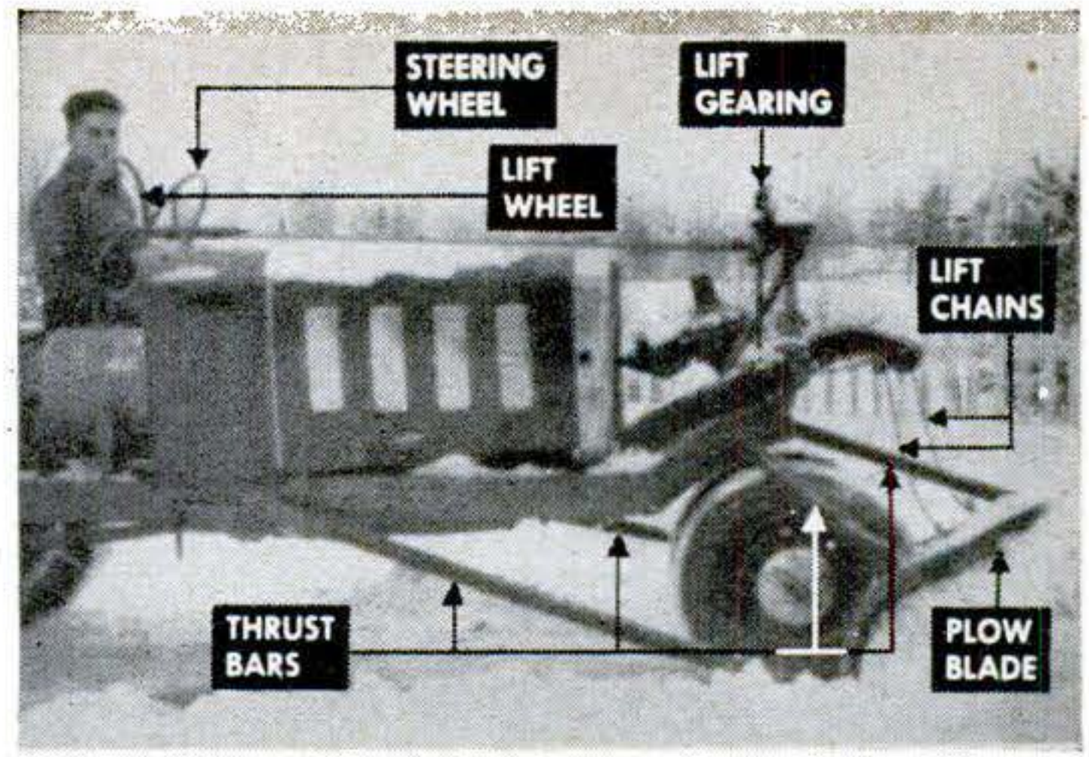
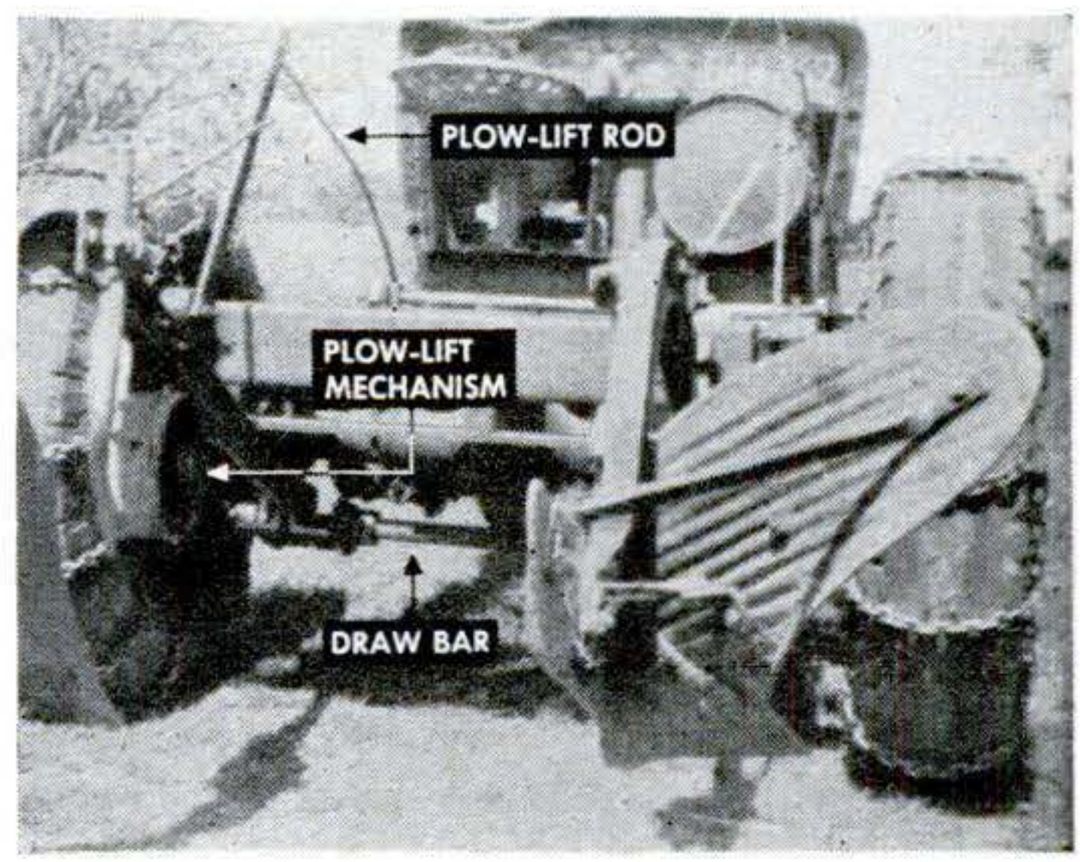


Plow-lift mechanism and mower power train fit in compactly. Rear end is from an old truck.



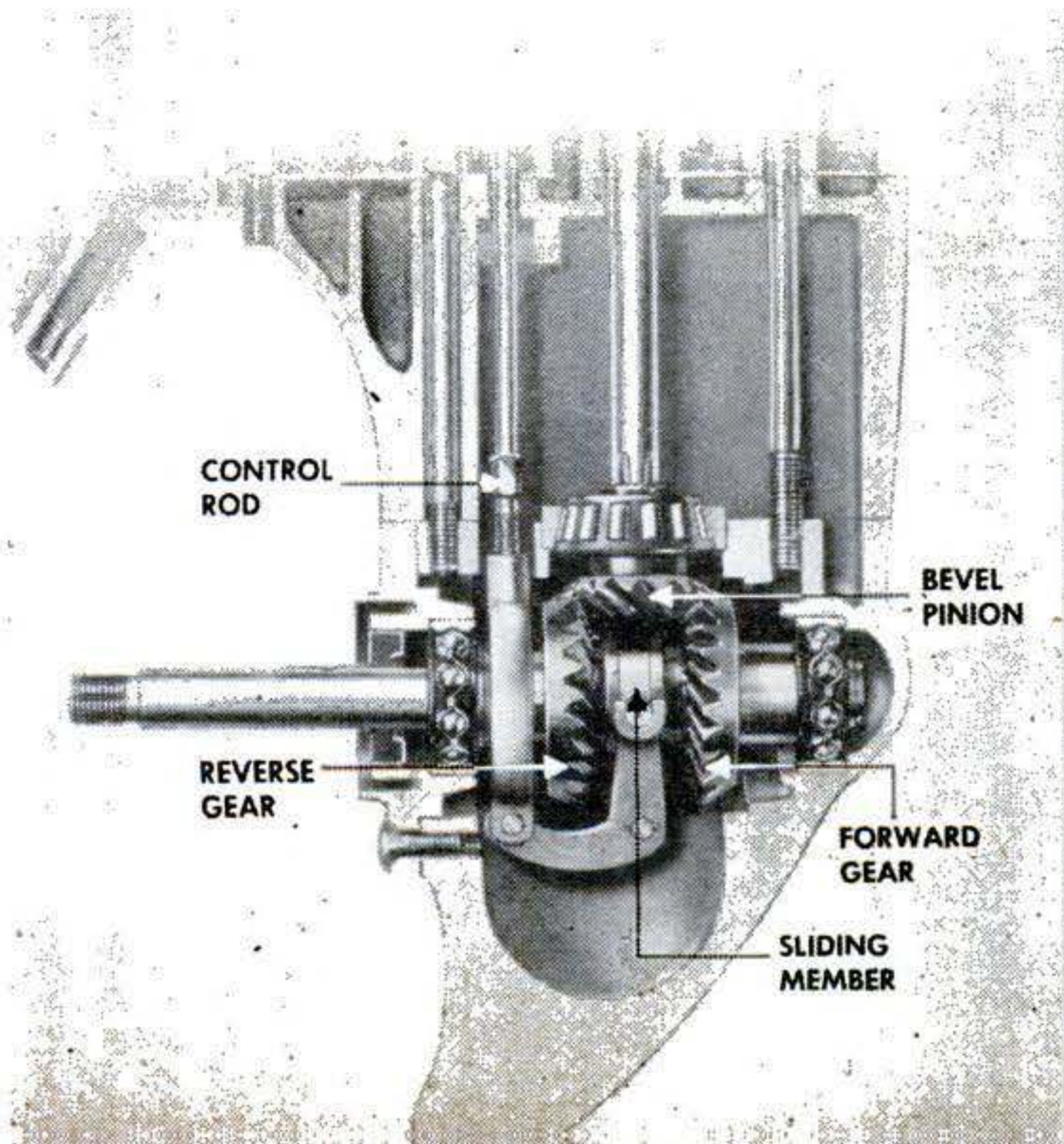
Snow's no problem despite a long driveway. The height and angle of the blade are adjustable.

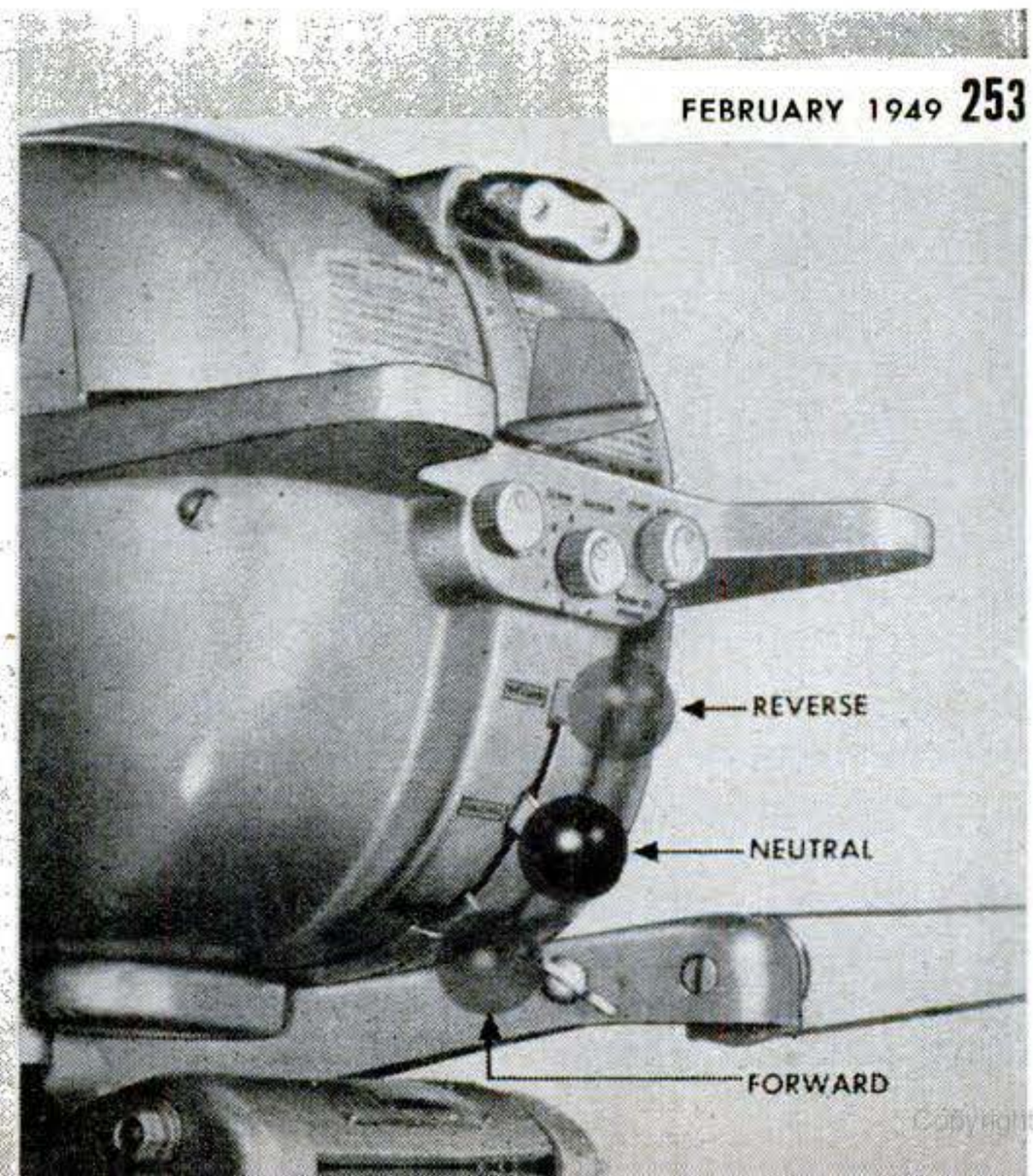


Flipping a valve lifts either or both plows. Big chain-covered tires are filled with water.

How New Reversing System for Outboards Works

A NEAT mechanical principle is used in new reversing outboards, as shown in these photos of a Johnson motor. A bevel pinion on the vertical shaft is constantly meshed with two bevel gears on the propeller shaft. Neither of these is fastened to the shaft. Between them is a sliding member keyed by splines to the propeller shaft. Small projections on the sliding part can engage similar ones on either bevel gear. The bell-crank linkage that moves it also limits throttle travel in neutral or reverse, and in reverse locks the tilt mechanism and diverts the underwater exhaust.





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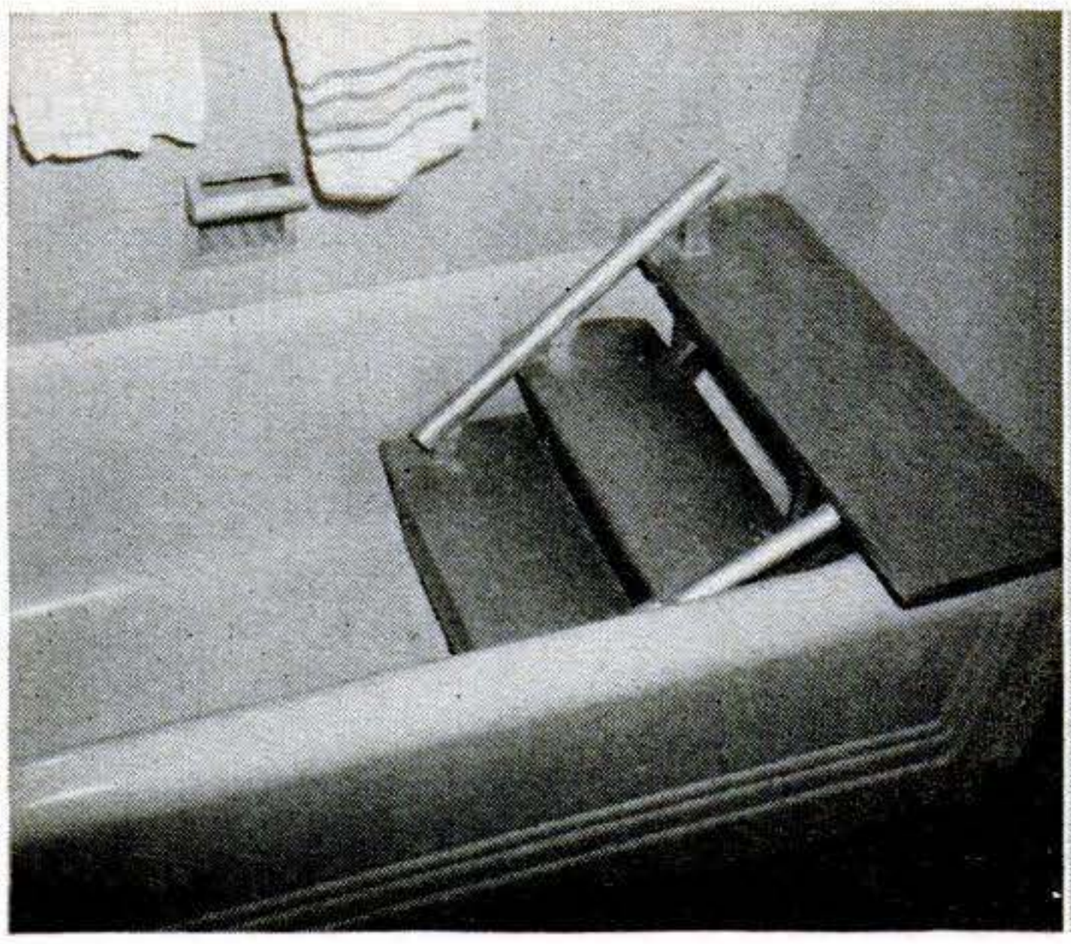
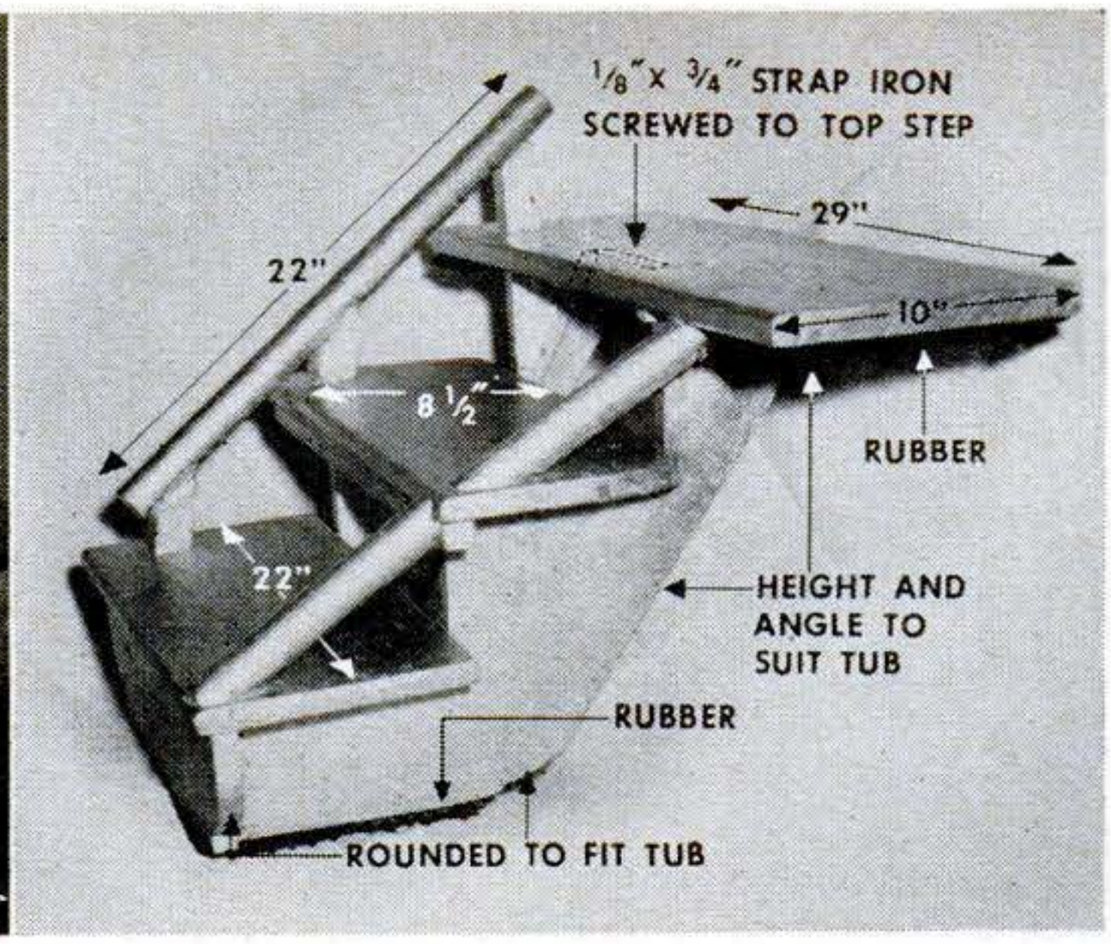
Stairway as Bathtub Safety Aid Prevents Falls





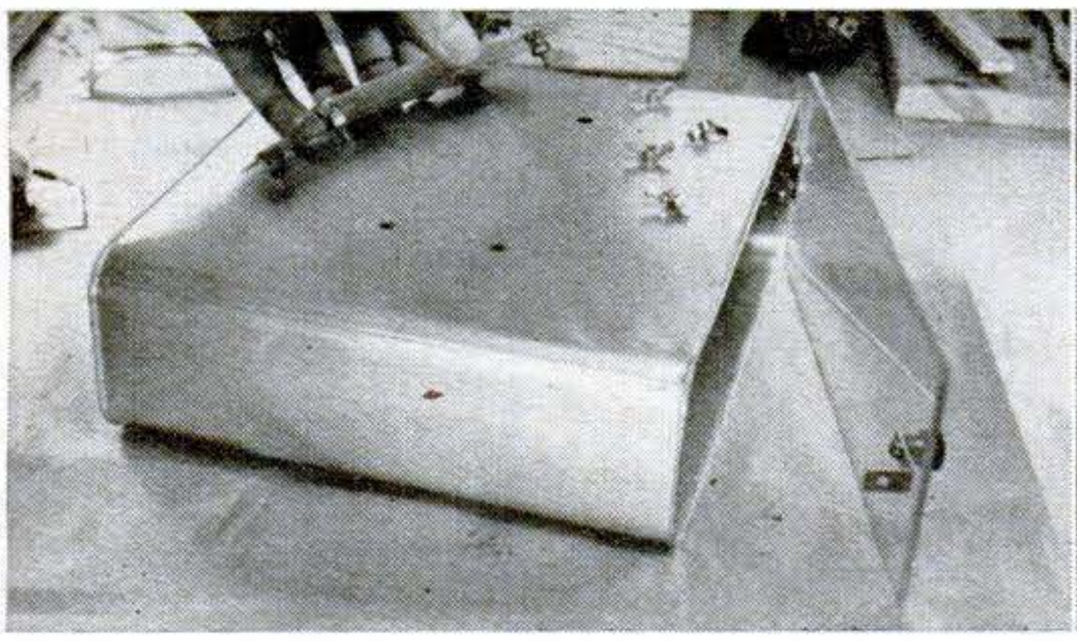
PHYSICALLY handicapped and elderly persons frequently have difficulty getting in and out of bathtubs unassisted. It was with this in mind that I built the stairway shown above for a patient. The user sits on the top step, swings the feet into the tub, and then hitches down the other steps. Even a seriously handicapped person can use it unassisted.

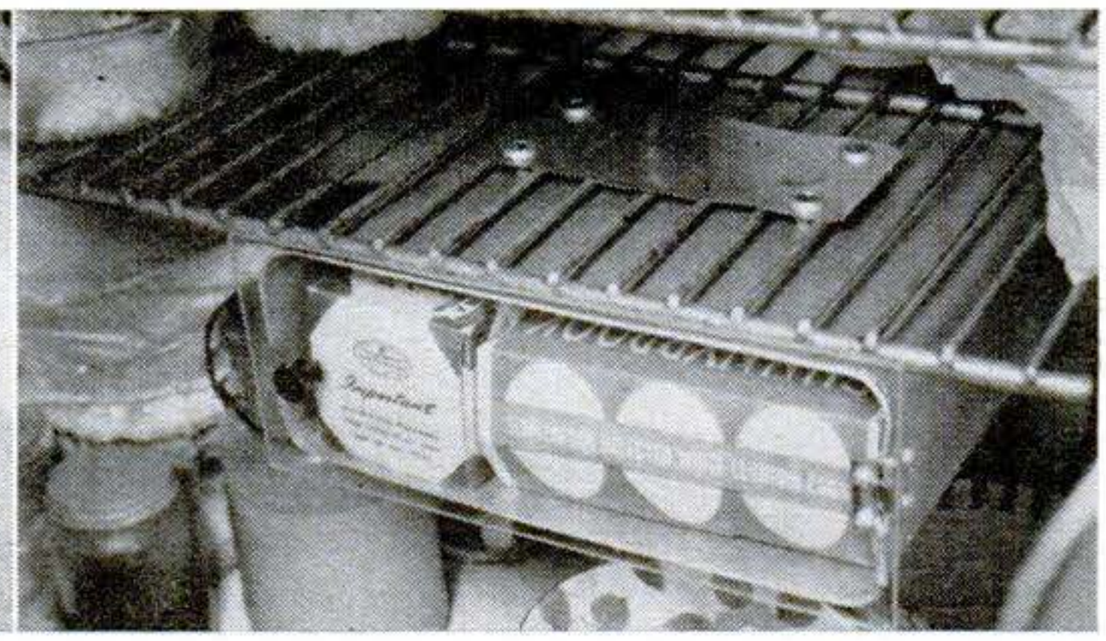
Fir was used for the handrails and redwood for the steps. The stringers are reinforced with ⅛" steel strips that are carried up and screwed to the underside of the top step. To prevent slipping, the top step and bottom board are shod with pieces cut from a rubber bath mat.

All parts are attached with waterproof glue and reinforced with screws. The front handrail was purposely lowered for ease in entering and leaving the tub.

The stairway was finished with three coats of aluminum paint and shows no effects from soap and water after several months use. Weighing but 12 lb., it may easily be removed, or left in permanently.—*George A. Skinner, M.D., Berkeley, Calif.*

Tin Can Makes Refrigerator Butter and Egg Nook





THERE'S usually some wasted space in every refrigerator—the area just beneath the wire racks. To utilize this space, I converted an old antifreeze can into a holder for a dozen eggs, a pound of butter, and a few packs of cheese. It clamps below the bars of a wire tray and has a hinged door of clear plastic. The can measures 3¼" by 8¾" by 9¼", and the door 3/16" by 3¾" by 9¾". A plastic knob and a small angle bracket make a friction catch for the door.

Cut the top out of the can, clean it up, and give it a coat of paint. With the handle removed, the top of the can forms the clamp. Cut it to 3" by 6" and drill four holes in it and in one side of the can. Use machine screws, wing nuts, and washers to attach the clamp through the wire shelf to the can. Drill one end of the plastic and the can for the small bolts that hold the hinge. It's a good idea to leave the masking paper on the plastic until you've finished the job. That way you'll avoid scratching it.—*Arthur Miller, Manhattan, N. Y.*

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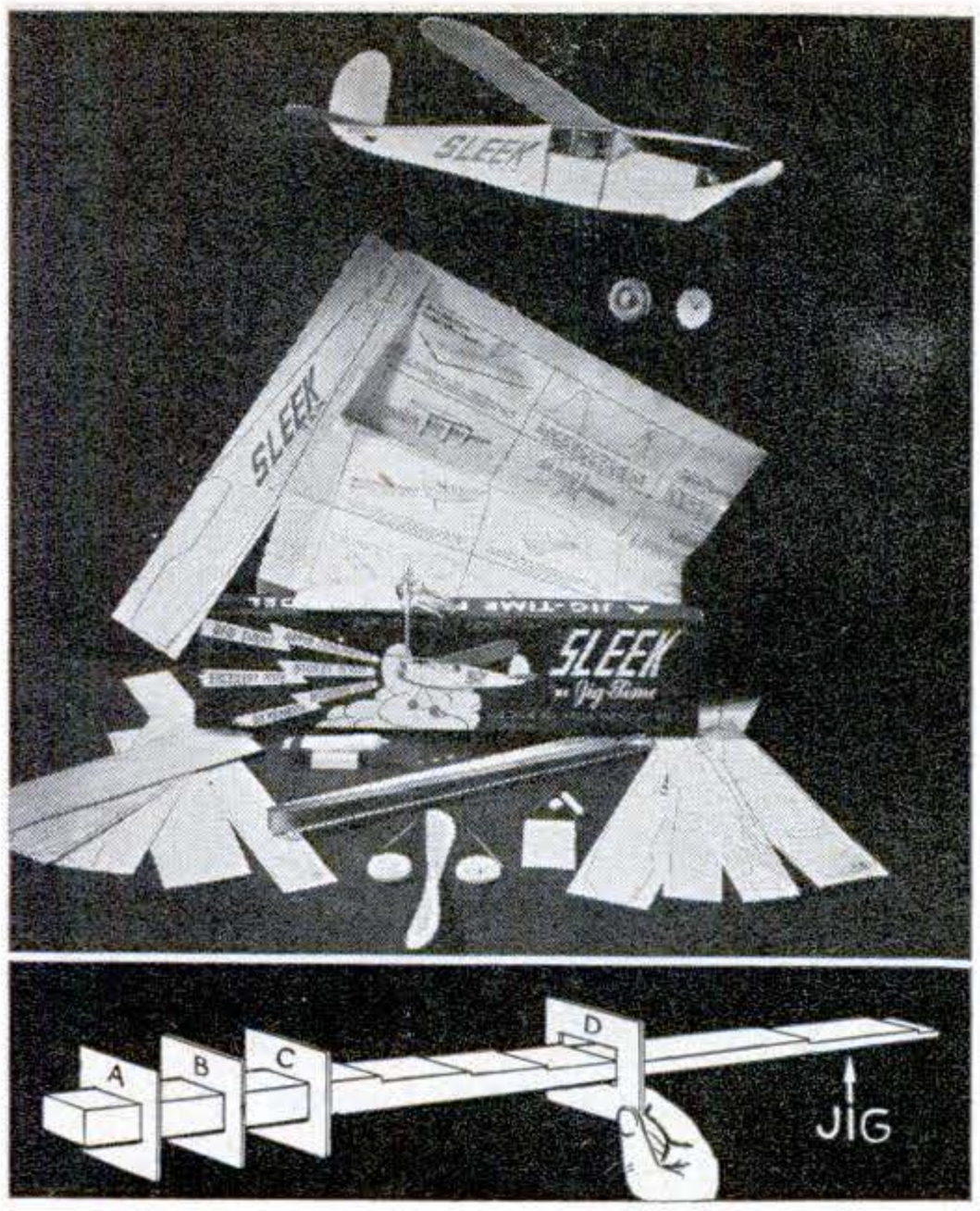
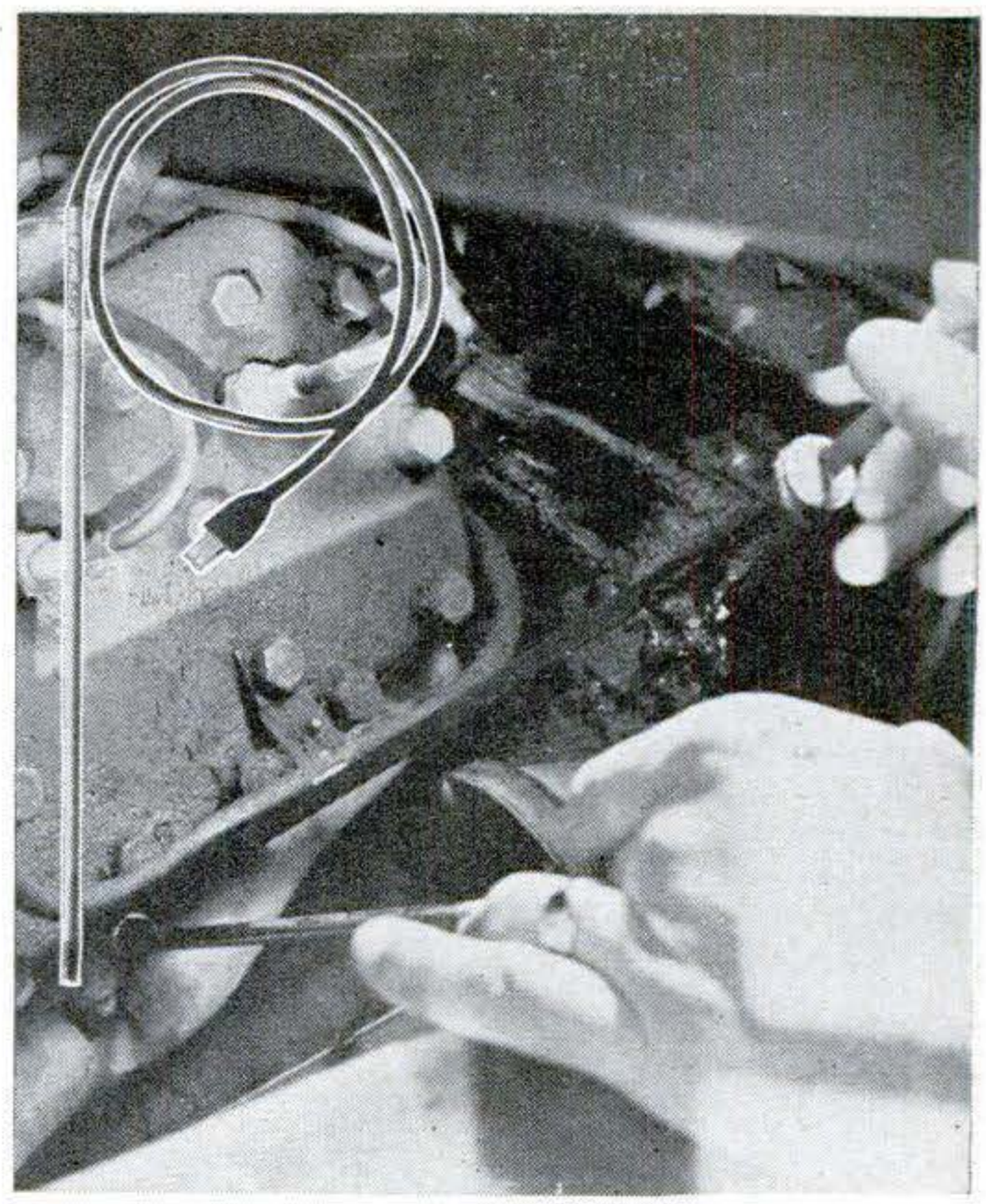


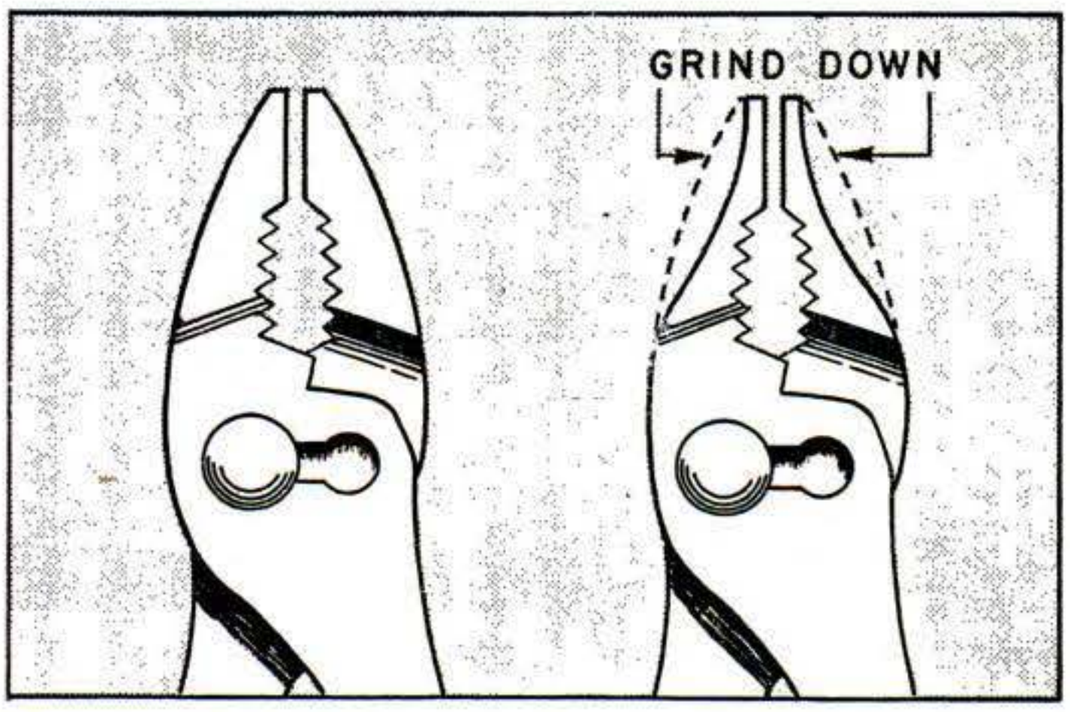
Model Plane Built in Jig

DESIGNED for tyro modellers, this monoplane with a 24½" wingspread is built in a metal jig. Outlines of all the parts are printed on balsa sheets. They are cut out, slipped in the jig, and glued together. When assembly is almost completed, the jig is slid out through the plane's nose. Hand wound, the 2½-oz. ship will fly for 25 or 30 seconds. If you use a winder, the flying time is boosted to around 45 seconds. It is priced about $2 by the manufacturer, Sidney Goldstein, of Washington, D. C.



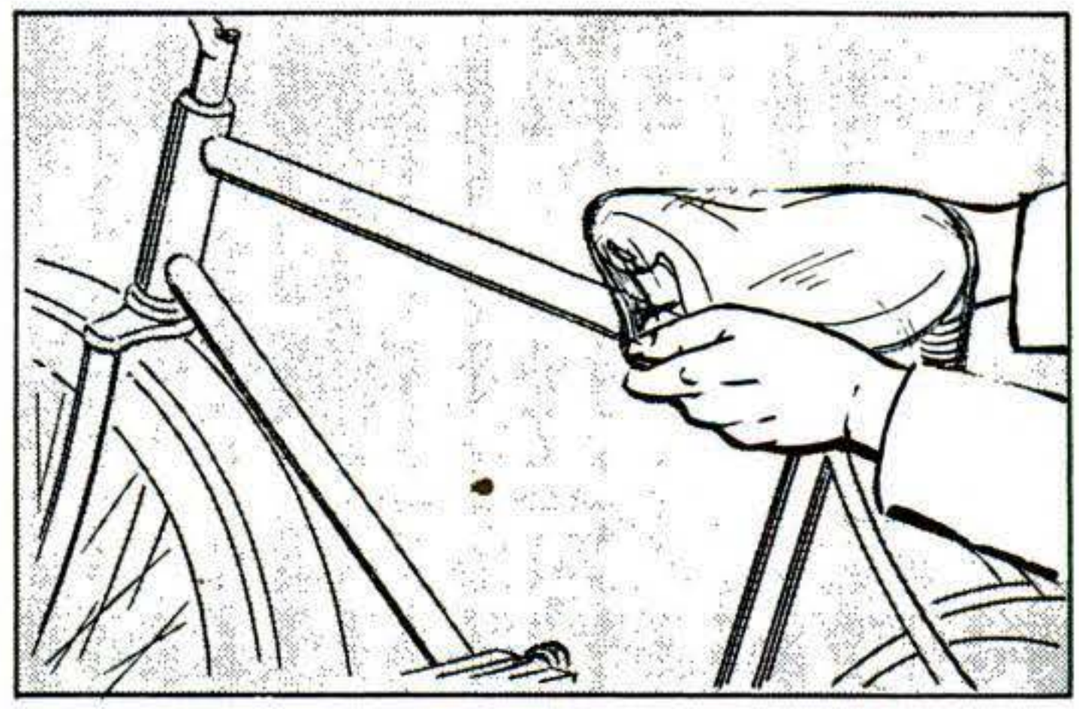
Dip-Stick Rod Heats Motor

A ROD-SHAPED heater that slips into the dip-stick opening keeps an engine ready for instant starting during cold weather. When the car is garaged for the night, the stick is removed and the heater inserted and plugged into a 115-volt AC or DC outlet. The Phillips Manufacturing Co., Minneapolis, Minn., says the Flash ® heater warms the oil and block, keeps the oil free-flowing, reduces condensation and saves the battery. Rated at 100 watts, the heater is supplied in two models—with a 3′ cord and a 12′ cord.



Nose of Pliers Ground Down

ALWAYS useful in radio and other electrical work, a pair of thin-nose pliers can be made by grinding down ordinary pliers. As long as ⅛" of metal is left, strength of the jaws will be sufficient for most tasks.—*Howard E. Graves, Huntington Park, Calif.*



Bowl Cover Protects Bike Seat

CYCLISTS can save themselves inconvenience if they'll carry along a refrigerator-bowl cover. When you park your bike outdoors, snap the cover over the seat. It'll protect the seat against dust, rain, and snow. —*Charles Byron Pease, Avon, N. Y.*

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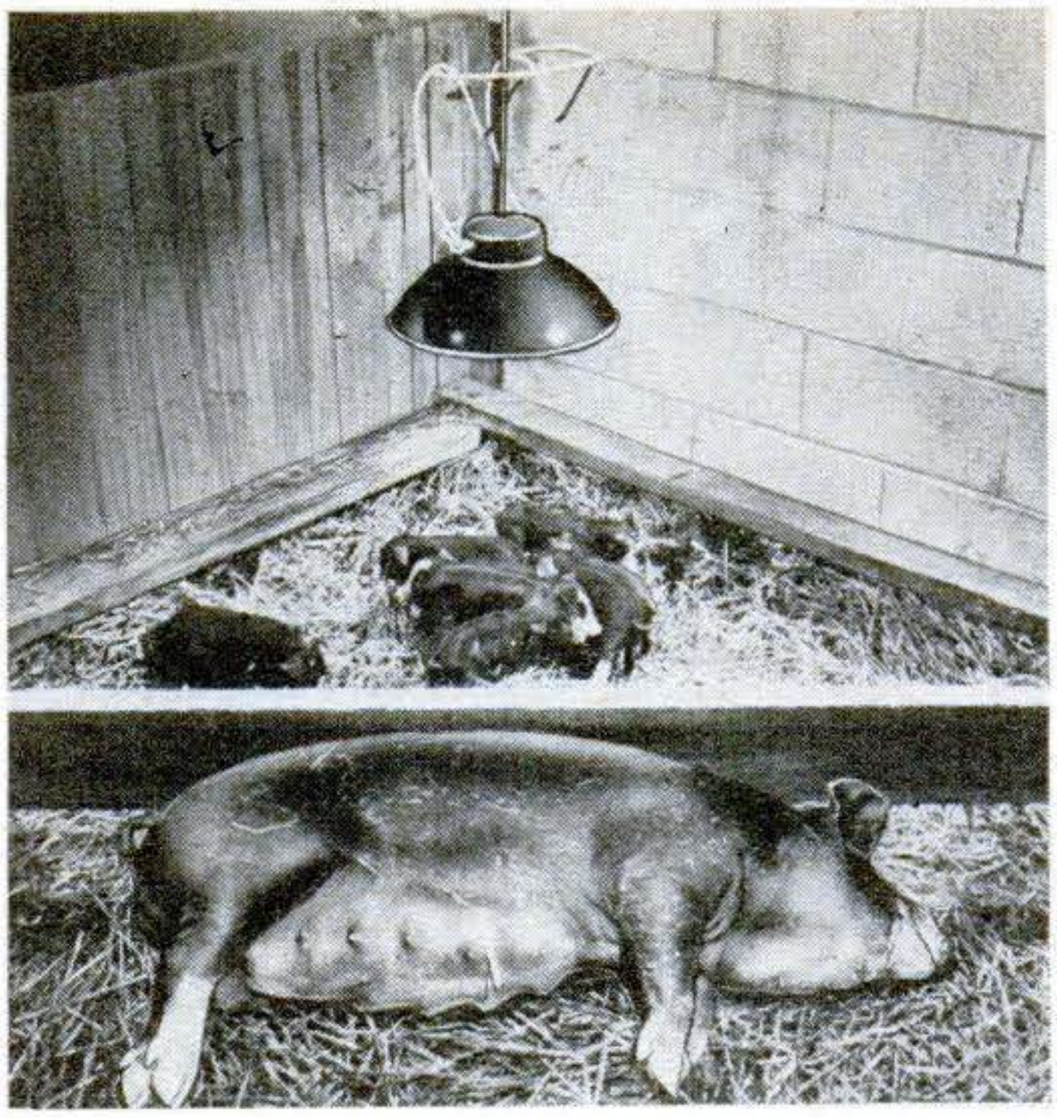
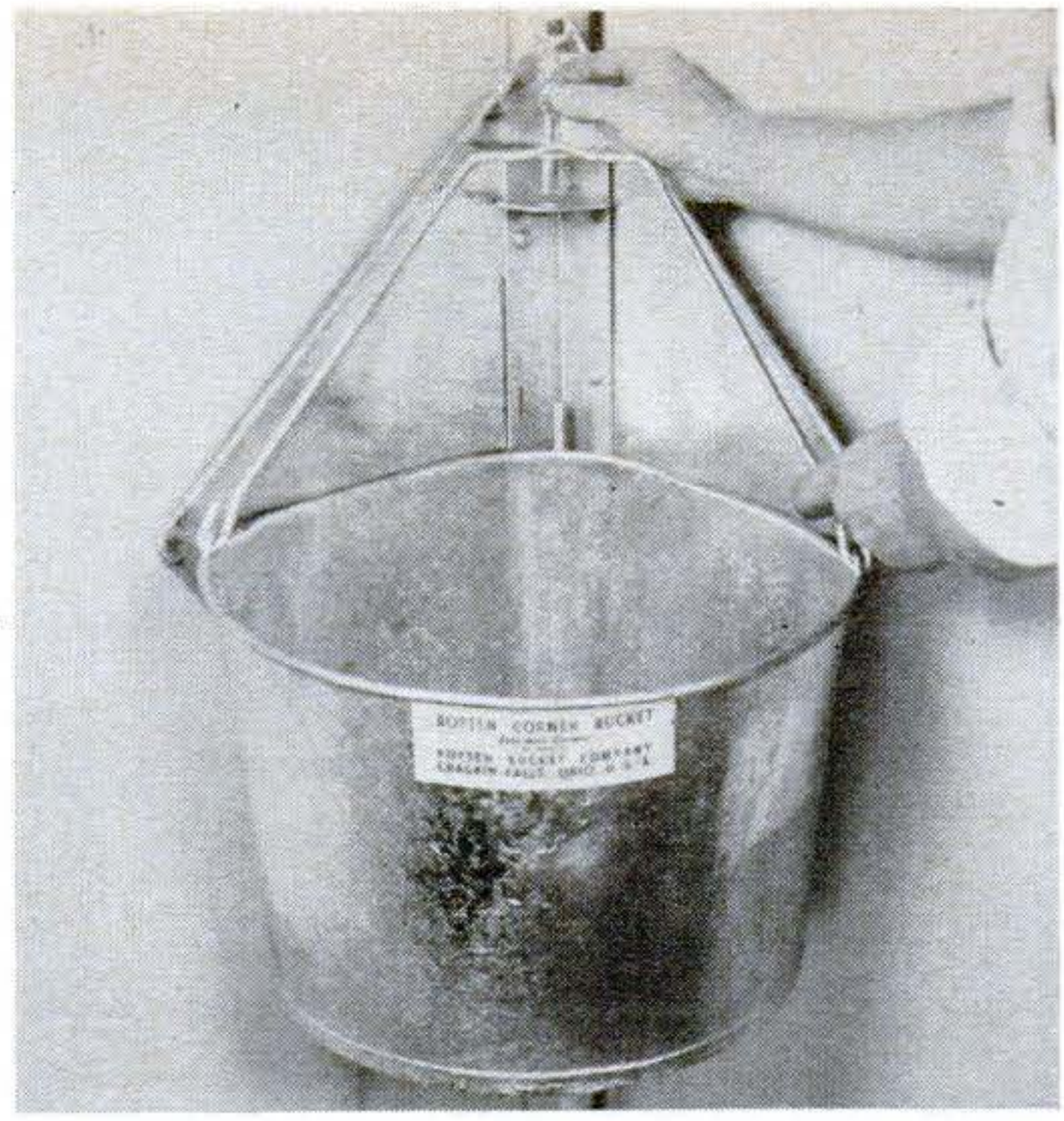


Infrared Heat Warms Pigs

LOSSES of new-born pigs during cold nights are said to be reduced by an infrared heater. The one above is made by the Dry Clime Lamp Corp., Greensburg, Ind. It costs about $18.

A board placed across the corner of the pen 6″ above the floor allows the pigs to move freely but prevents the sow from squeezing into the corner. Placed above the pigs, the lamp has enough power to prevent a dangerous temperature drop.



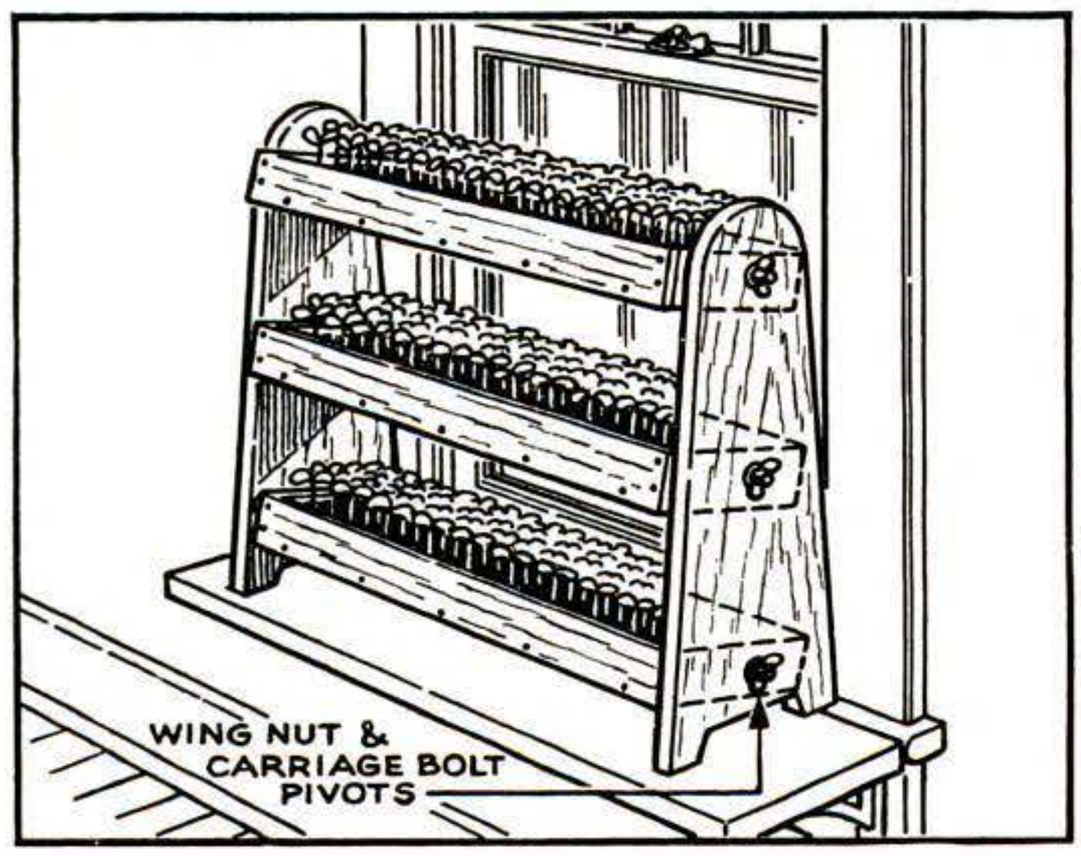
Feed Bucket Fits into Corner

BUCKETS manufactured by the Botten Bucket Company, of Chagrin Falls, Ohio, for feeding and watering livestock are shaped to fit into a corner of the stall.

They're sold with a bracket that's permanently installed in the corner. A removable pin secures the bucket to the bracket. The buckets can also be equipped with an internal ring that keeps the animal from rooting feed out of the bucket. A bucket, bracket, and feed-saver ring cost about $10.

Peat Humus Packed in Plastic

IF YOU buy a supply of peat humus for your garden this spring, you may find it packaged in a new way. Shore Line Industries, of Clinton, Conn., are now producing packages from Bakelite polyethylene for this purpose. Unlike a paper container, the plastic one won't decompose from organic activity in the humus.



Stand Supports Seedling Flats

MANY persons must start early garden plants in one or two windows. Here's a way to make better use of the space.

Stack the flats one above the other by building a stand as shown. Pivot each box so you can tilt it to face the sun. Next day turn the stand around and tilt the boxes the other way to straighten the growing plants.

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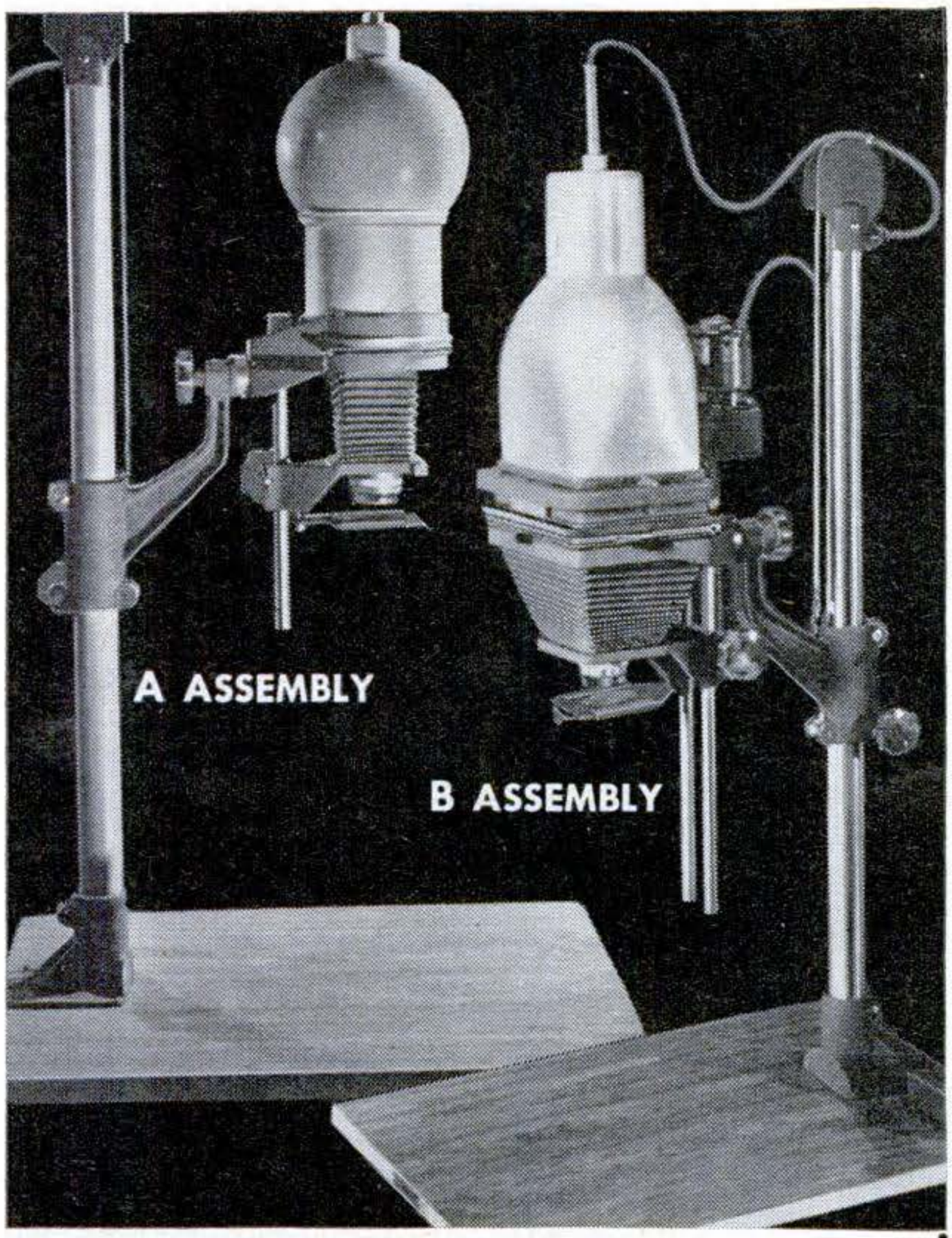
Magnificent Enlarging *PLUS*

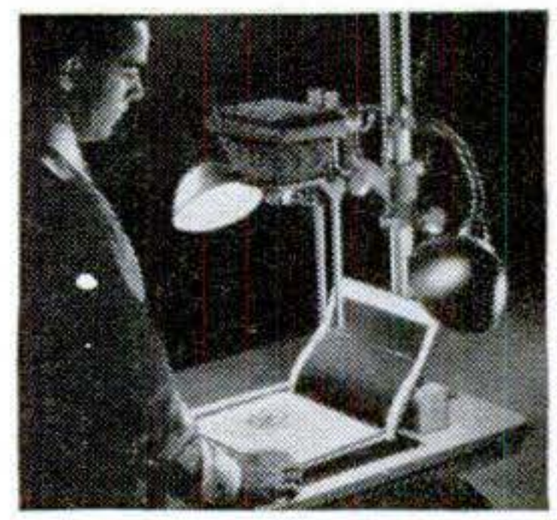


KODAK PRECISION ENLARGER
(Showing A and B Assemblies)

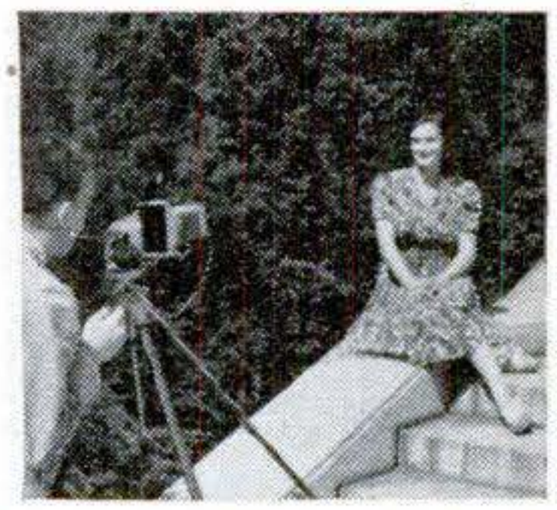
Stand assembly takes either the *A* or *B* enlarger head. *A* assembly accepts negatives up to 2¼ x 3¼ inches . . . has friction-wheel drive for exact focusing. *B* assembly takes negatives up to 4 x 5 or 3¼ x 5½ inches . . . cooling system includes motor-driven fan. Wide selection of Kodak Ektar and Ektanon Lumenized lenses results in superb projection prints. At your dealer's.

Eastman Kodak Company
Rochester 4, N. Y.

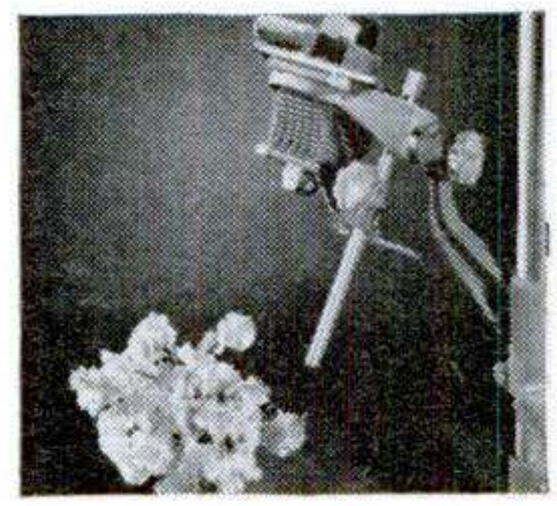
Kodak



COPYING AND SLIDE-MAKING— Camera back adapter, bellows assembly, and lens make a fine camera. For copying, use stand assembly and copying lights.



AN INDEPENDENT CAMERA —For indoor and outdoor work, camera back adapter, bellows assembly, and tripod adapter make a "view-type" camera.



CLOSE-UP PHOTOGRAPHY— By assembling as a camera and utilizing the lengthy extension of the bellows.

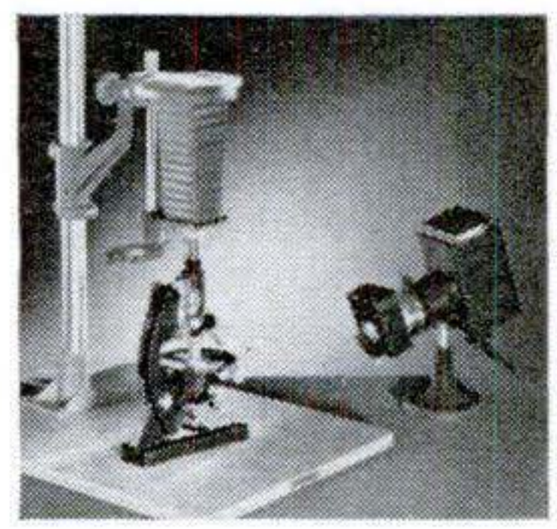
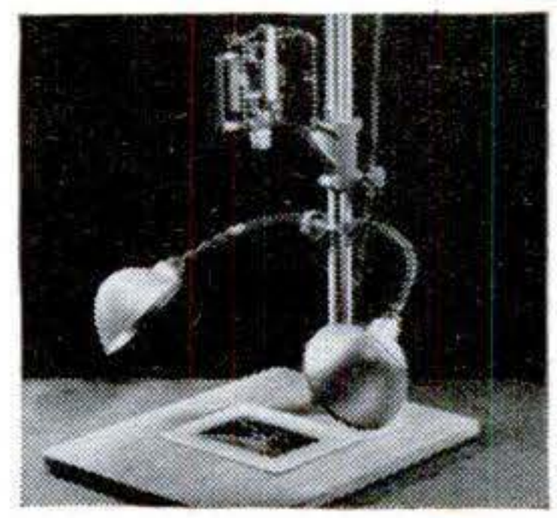


PHOTO-MICROGRAPHY— The microscope attachment makes light-tight connection with the microscope. Exposure controlled by microscope lamp.



CINE-TITLING— The inclined arm of the stand assembly supports a Cine-Kodak camera for making titles.

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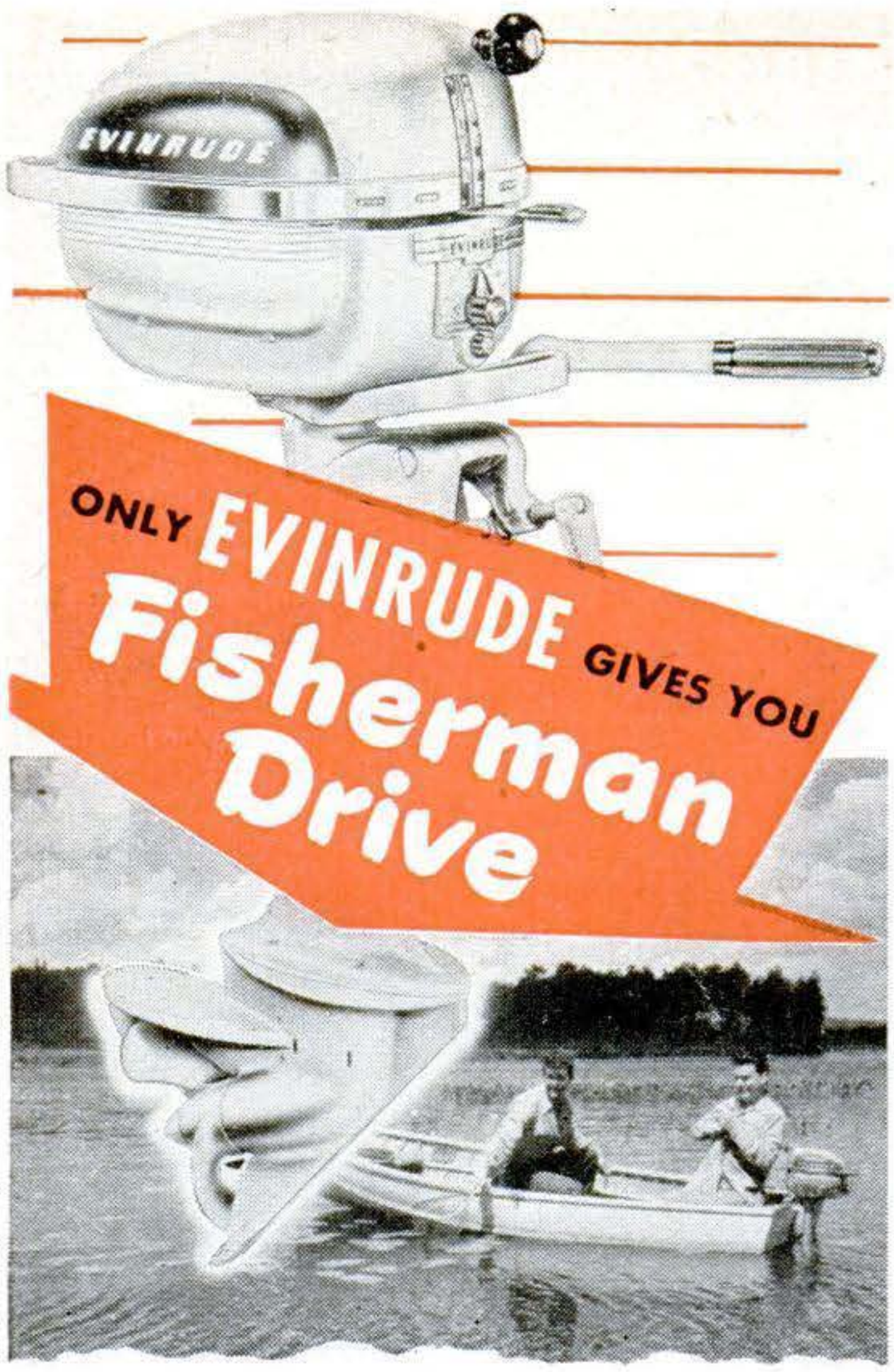

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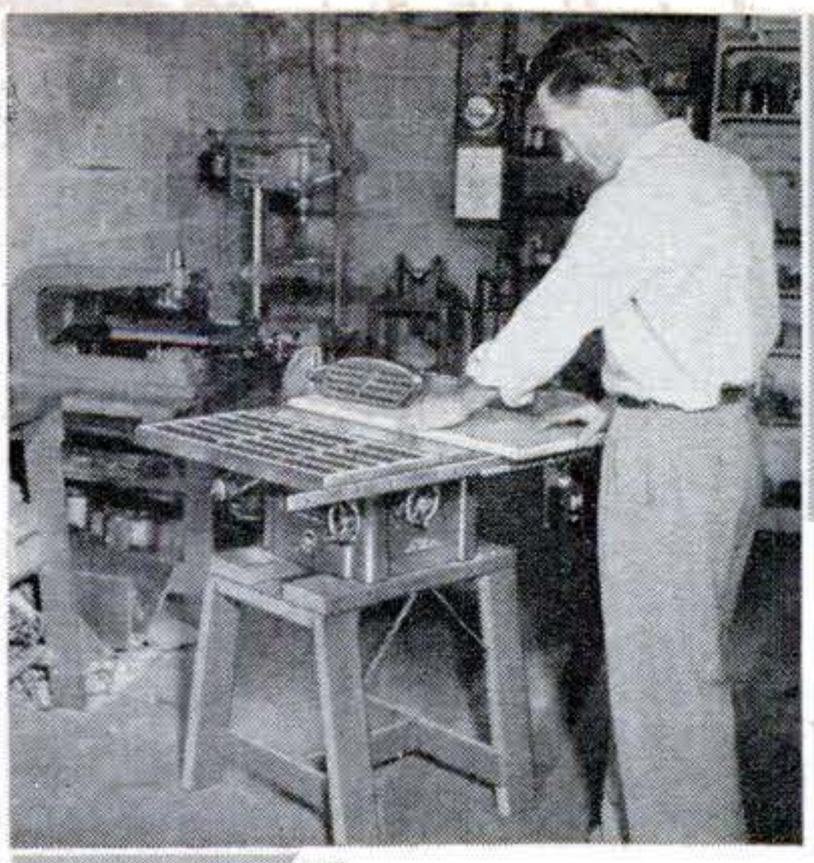

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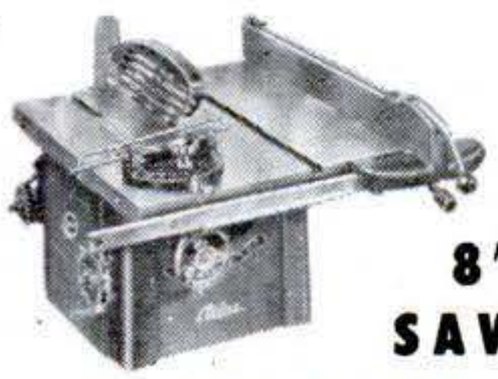
10" SAWS

No. 3060 has 25" x 22" table — 12¾" ahead of blade, 12½" from blade to fence. Cuts 3¼" deep. Has dual V-belt drive. Comes ready to run, less motor, for..... **$115.00**



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No. 3020 has 22" x 18" table with 10⅝" ahead of blade, 9½" from blade to fence. Cuts 2⅜" deep. Comes fully equipped, less motor, for only..... **$89.75**

Any man looking for the best in equipping his shop will find *everything* he has in mind in these new Atlas saws.

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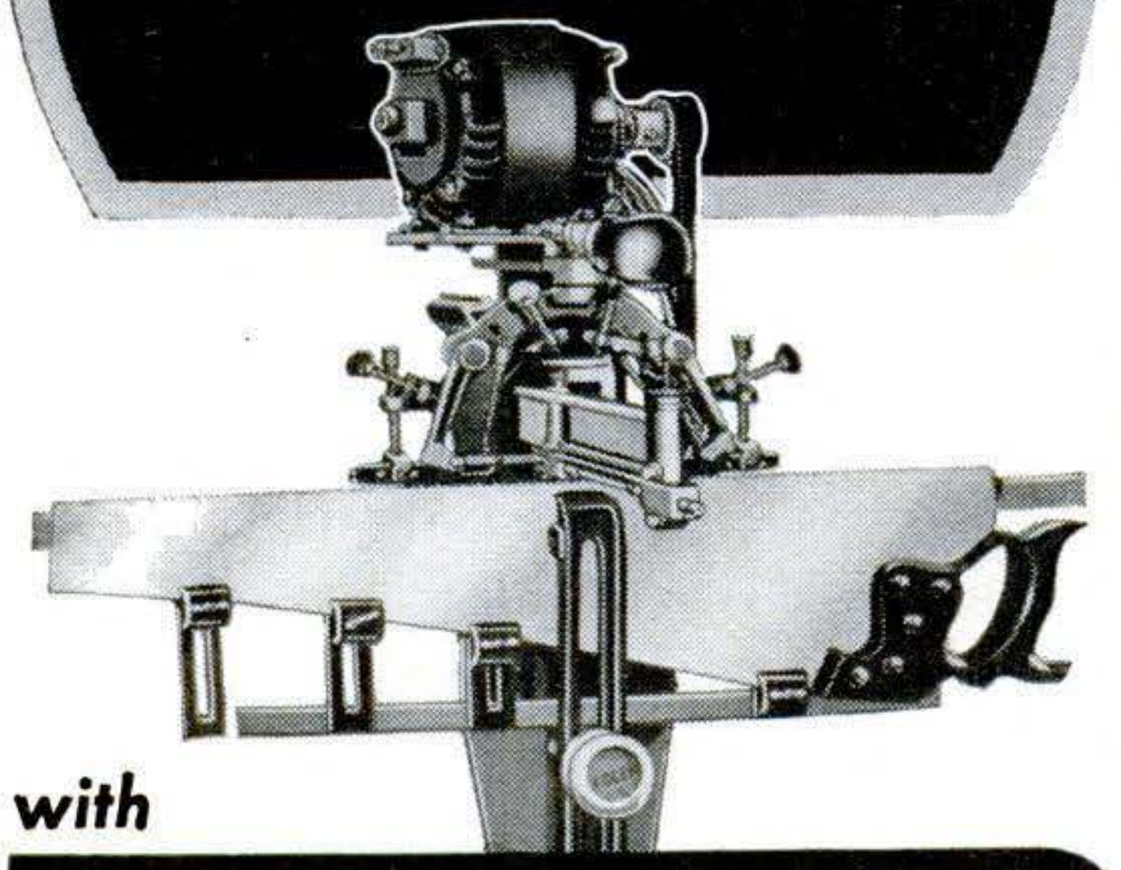

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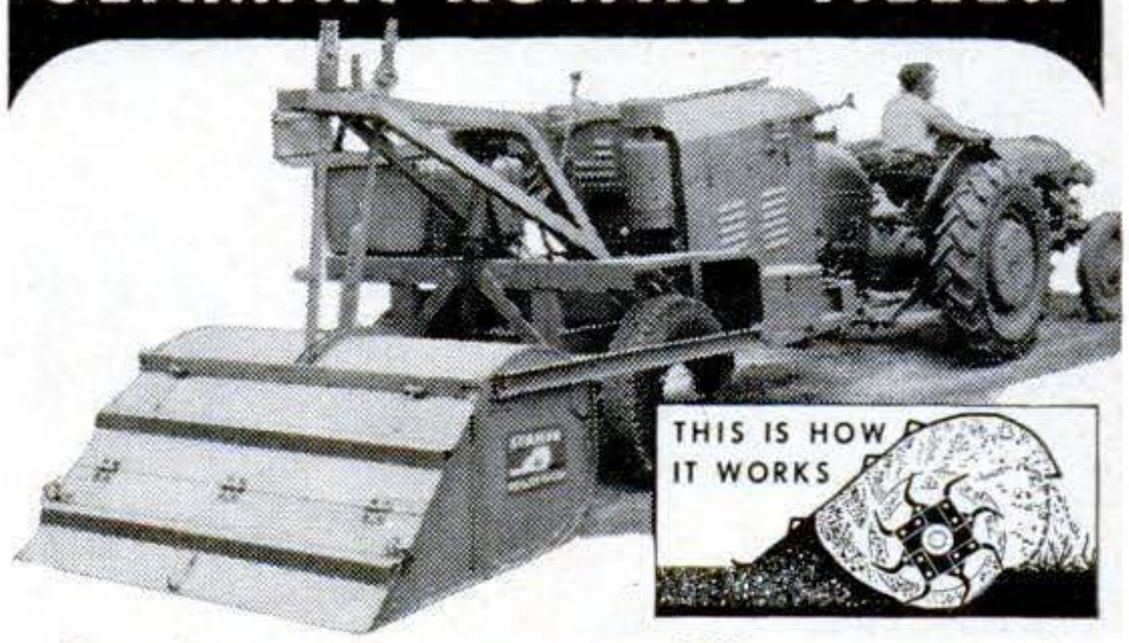

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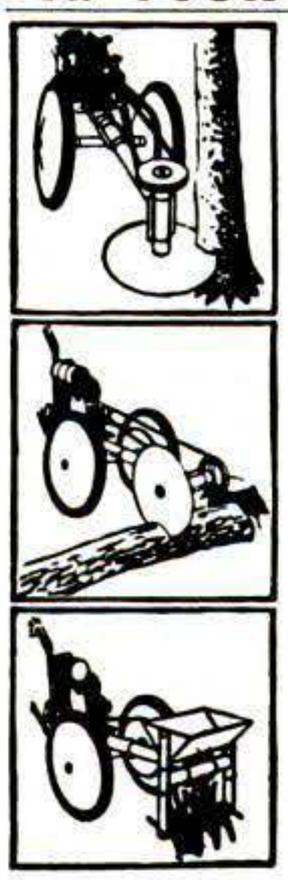

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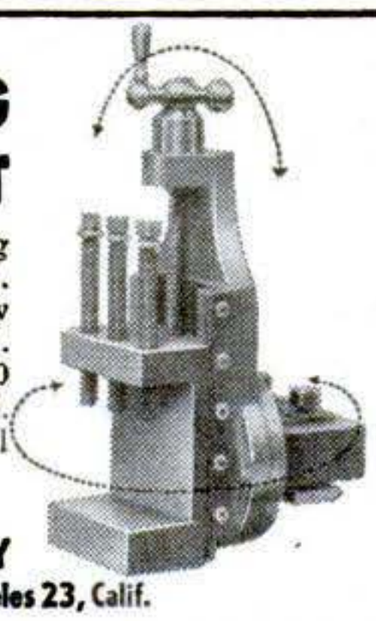

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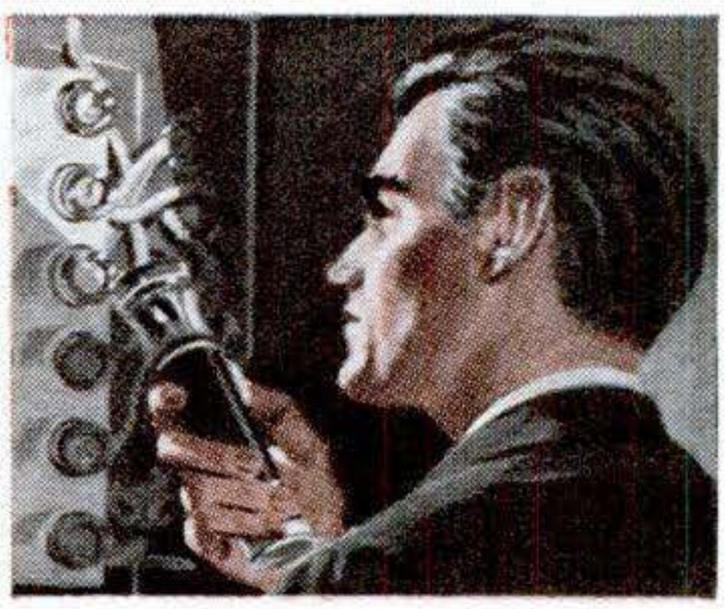

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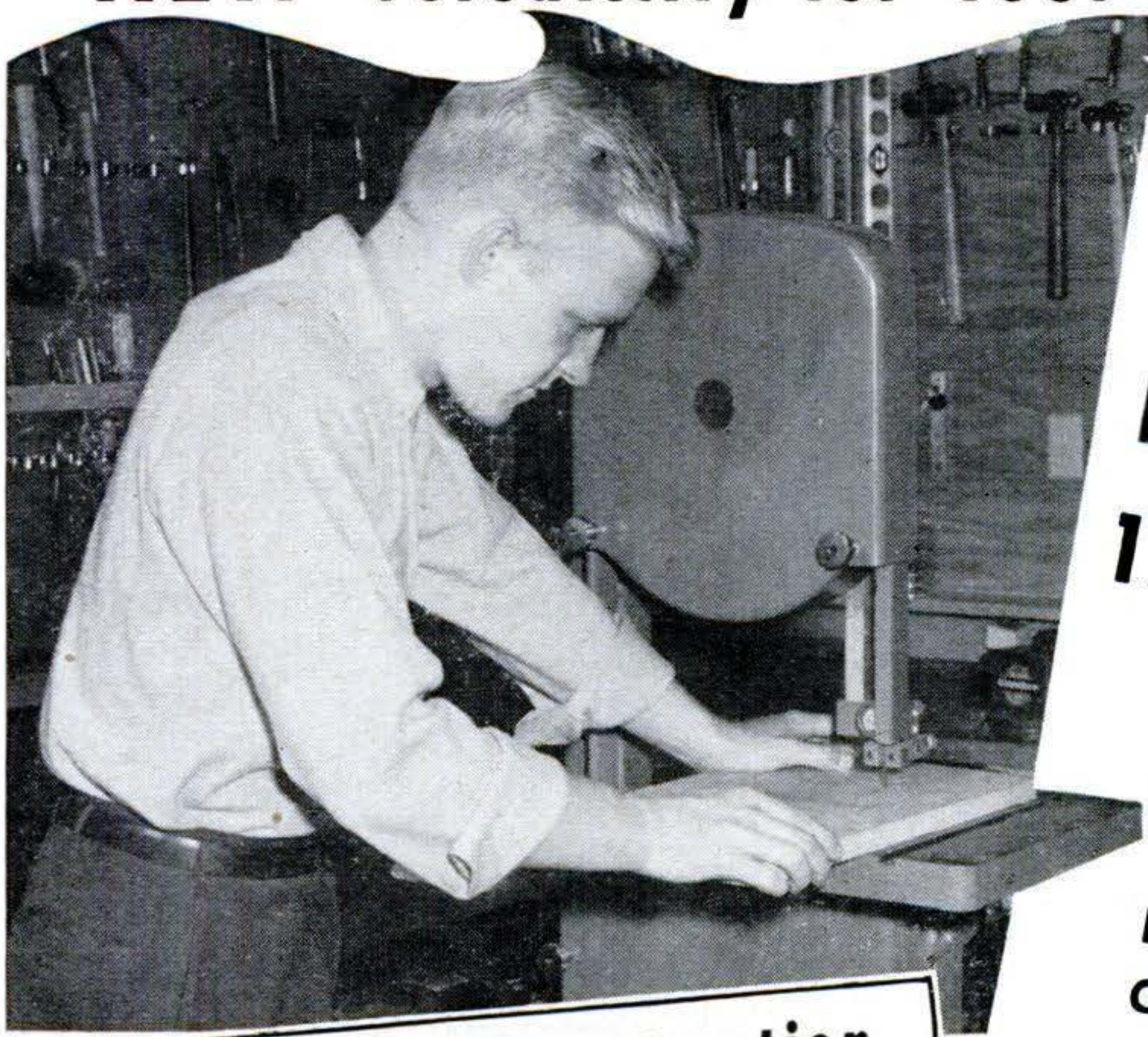

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You can increase the usefulness of your shop a dozen-fold with the new low-cost Power King 12" Band Saw — turn out "professional" work fast and easy!

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CAPACITY 1000 BLOCKS PER DAY

ONLY $199 LESS MOTOR F.O.B. PLANT
SHIPPING WEIGHT 400 lbs.

Cinder and Concrete Blocks in big demand. Sell all you produce, to contractors and builder supply yards, at 15c to 25c each. Easy to start your own profitable business.

GENERAL BLOCK MACHINE can be operated indoors or out, in floor space 9 ft. x 10 ft. All steel construction. Vibrator mounted in sealed ball bearings. Simple to run. Powered by ½ H.P. electric motor or 1 H.P. gas engine. Produces up to 1,000 8x8x16 blocks in 8 hour day. Superior 3 core type, meeting all building code requirements. Produces 4x8x16, 8x8x16, 12x8x16 blocks. Material for blocks, cinders; cement; and sand; obtainable anywhere. Full instructions and mixing formulas with each machine. Immediate Delivery. Mail coupon at once for full details, sent free without obligation.

HOW TO BUILD YOUR OWN CONCRETE BLOCK HOME Only $1 Prepaid

Wonderful book written and illustrated by our staff of experts.

GENERAL ENGINES CO.
(EASTERN DIVISION) DEPT. B-B—DREXEL BLDG., PHILA. 6, PA.

Shows you 8 ways to save money and how to make and lay blocks, laying out building lines, mixing your own concrete, building steps, porches and concrete floors, includes floor plans for 6 beautiful easy to construct concrete block bungalows. Mail coupon at once with $1.

Name .....
Address .....
City..... Zone... State.....

TAKES THE GUESSWORK OUT OF MEASURING!

The unique design of this fine measuring instrument makes guesswork and inaccuracies in **measuring a thing of the past. Note the lever brake for holding a reading on an inside measurement — which is read directly on the rule — no adding or subtracting. Extra long tip, graduations on both sides of the blade and smooth sliding action are only some of its outstanding features. Add to these its rugged construction, sleek polished chrome finish, and you have the finest in steel tapes. 6 and 8 foot lengths. Blades replaceable.**

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WOOD AND STEEL TAPE RULES

Master Rule Mfg. Co., Inc.
201 Main Street, White Plains, N. Y. PS-2

I enclose $2.25 for the 6 ft. Streamline
$2.50 for the 8 ft. Streamline
Engrave my name (75c extra). Please print clearly.

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CITY..... STATE.....

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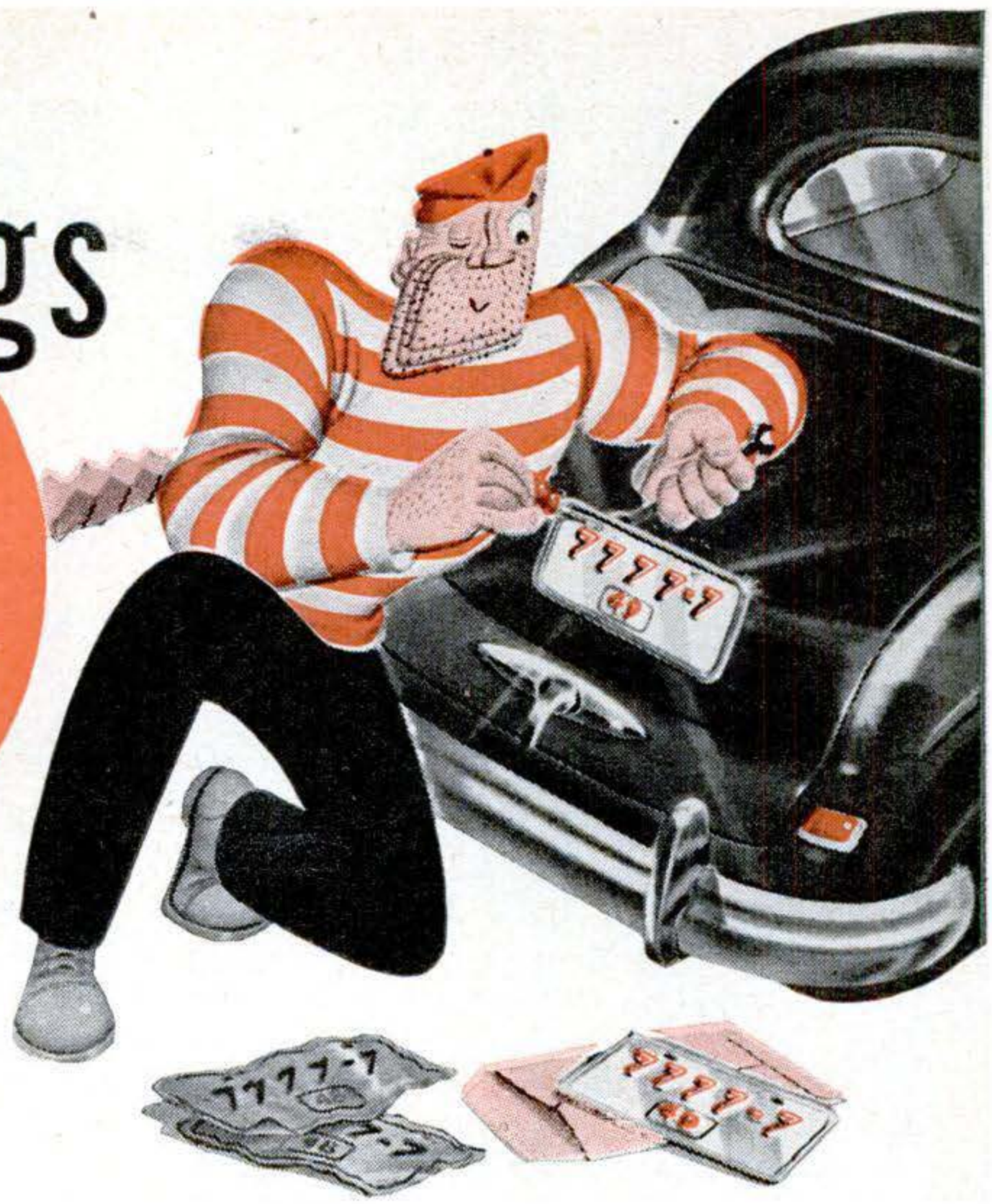
Piston rings need replacing too!



● Oil-pumping in your car flashes a warning that your piston rings are worn and should be replaced immediately.

Fortunately, replacing piston rings is a comparatively simple and inexpensive job.

And when you replace with Hastings Steel-Vent Piston Rings, you *stop* oil-pumping, *check* cylinder wear and *restore* performance.

It's the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY • HASTINGS, MICHIGAN

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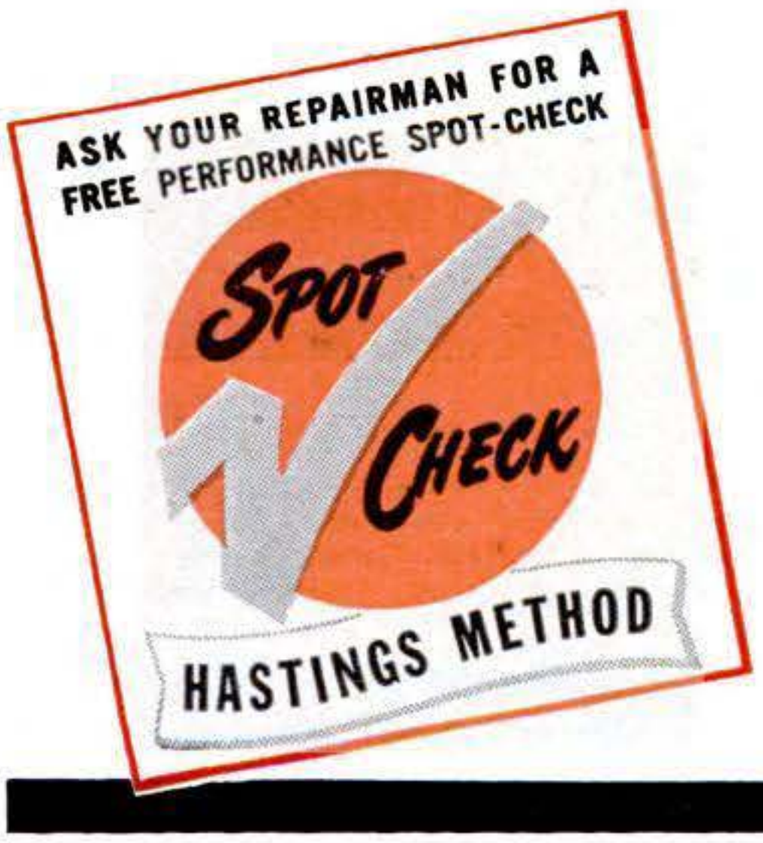

HASTINGS

STEEL-VENT PISTON RINGS

"TOUGH... BUT OH SO GENTLE"

TOUGH on oil-pumping—GENTLE on cylinder walls

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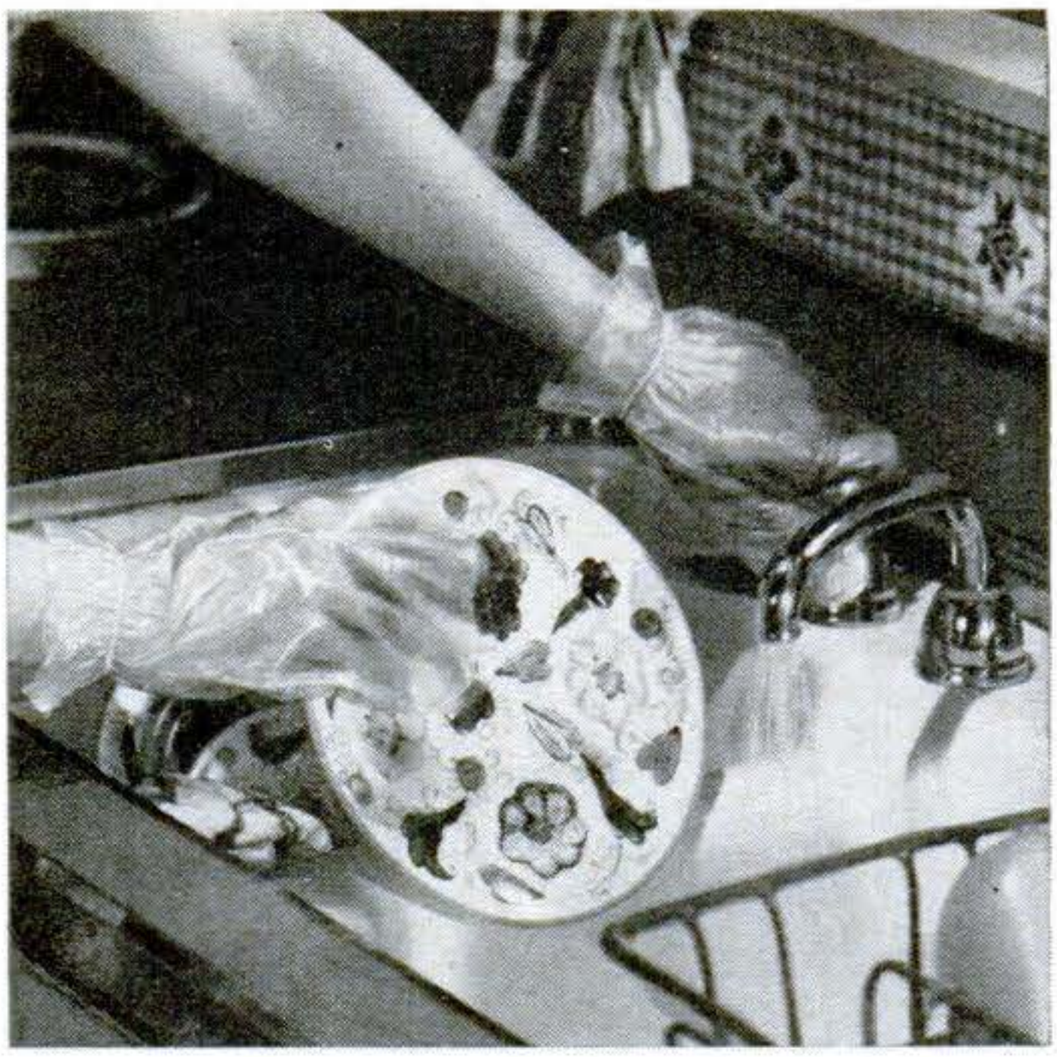
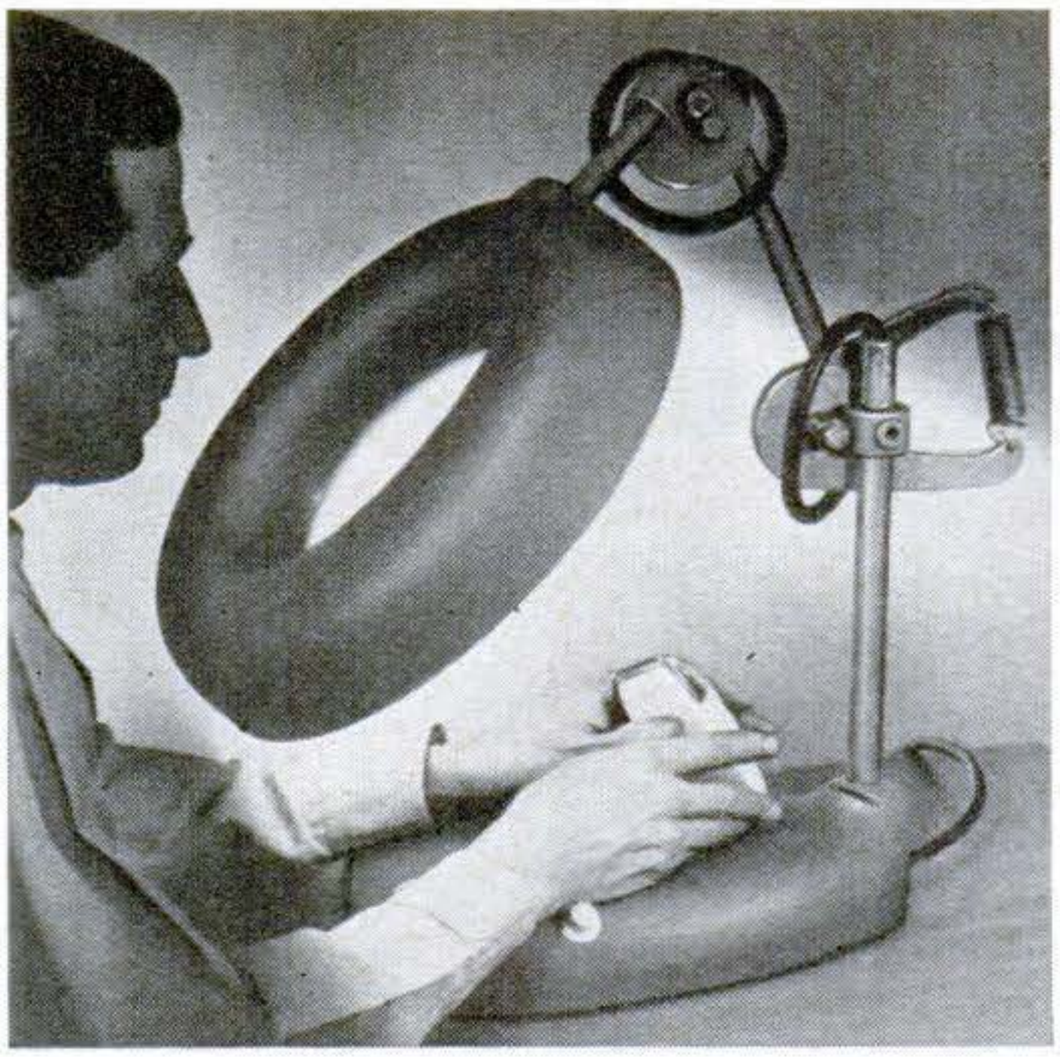


Plastic Mitts Protect Hands

THESE kitchen mitts, to protect a housewife's hands and nail polish, are quicker to slip on and off than rubber gloves. Big enough to allow complete finger freedom, they also fit on either hand. Servette Corp., of New York, makes the new mitts of flexible, transparent Vinylite ® plastic that is unaffected by acid, grease, or stains.



Magnifier Has Big Eye

THE magnifier above has an 8-inch lens circled by a 12-inch fluorescent light. The result is a large, illuminated area for examining or working on an object. Two elbow joints in the cast-iron stand permit accurate positioning of the lens. The magnifier, called Supersite ®, was developed by the Safety Center, of Chicago.

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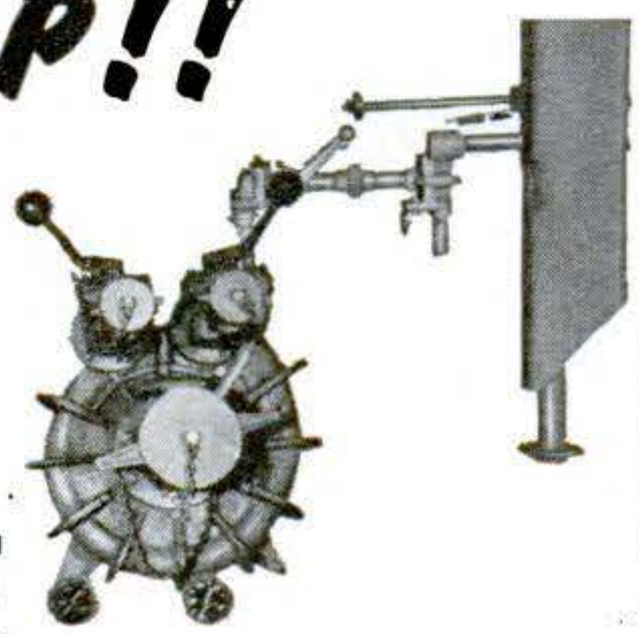
SCOOP!!

BRAND NEW

HIGH VOLUME CENTRIFUGAL PUMP



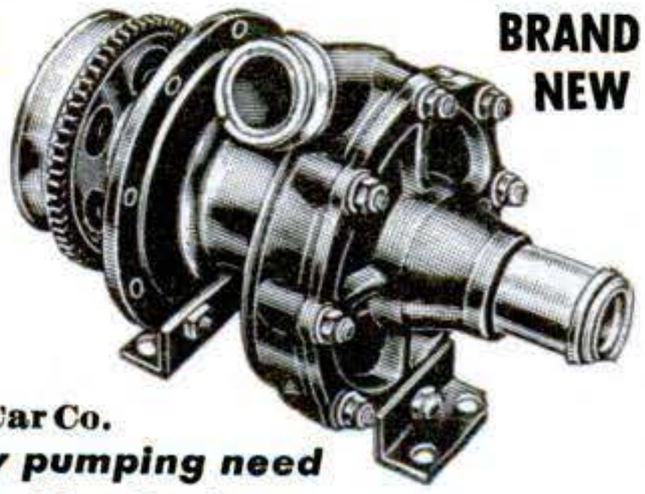
For fire protection, irrigation, de-watering, industrial uses, farm uses, etc.

Pumps rated 500 gallons per minute at 275 ft. head pressure; equipped with 1½" diameter straight splined shaft for direct coupling drive; 4½" threaded suction intake; two—2½" threaded discharge outlets; Hale Pump Co. Model CF volute type; requires 37 H.P.; dimensions: 21" x 24" x 28". Complete with full accessory kit including suction and pressure gauges, priming equipment, and instruction book. Ship. wt. 415 lbs. Gov't acquisition cost $425.00. NOW . . . . . .

$149.50 F.O.B. Chicago

ALL-PURPOSE WATER PUMP

BRAND NEW



Mfd. by Packard Motor Car Co.
Ready for use on any pumping need

Use it for:
DRAINING BASEMENTS
HOME WATER SYSTEMS
FIRE PROTECTION
PRESSURE BOOSTER
IRRIGATION
DRAINING PONDS, TANKS, etc.
SPRINKLING SYSTEMS
STOCK WATERING
INDUSTRIAL PUMPING

Complete with pulley and mounting brackets, ready for use.

Belt Driven Centrifugal Pump

An extraordinary value for all types of intermittent or continuous pumping in the home . . . farm . . . factory. Built to exact specifications of Packard Motor Car Co. for use in Rolls-Royce Merlin Aircraft Engines. May be run with electric motor, gas engine or power take-off on tractor. Delivers up to 25 gallons a minute with ¼ H.P. motor; 80 gal. a min. with one H.P. motor. Will deliver up to 44 ft. head or 25 ft. suction. Use 1" outlet hose; 1" or 1½" inlet hose (recommended).

Complete Engineering Reports and Operating Instructions Free with Pump

Has cast aluminum housing, accurately machined 5" bronze impeller; 3½" V belt pulley and mounting brackets. Shaft rotates on ball bearing; has grease gun fitting.

Original cost approx. $88.00. Shipping weight 10 lbs. A REAL BUY.

$21.50 F.O.B. Chicago

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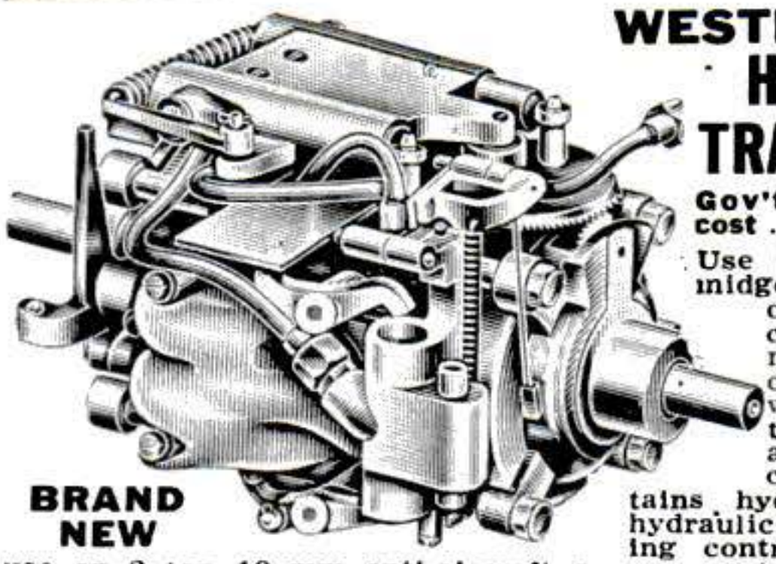

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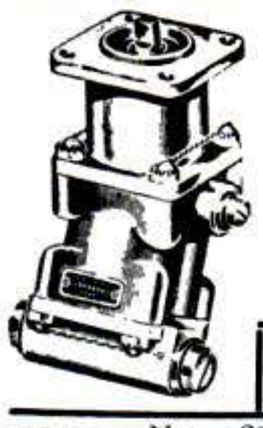
WESTINGHOUSE HYDRAULIC TRANSMISSION

Gov't. Acquisition cost $300.00

Use it on chain saws, midget autos, lathes, drills, power machinery, chucking machines, farm machinery, potters' wheels, tractors, trucks, etc. Ideal as hydraulic torque converter. Contains hydraulic pump and hydraulic motor; has reversing controls. Designed for use on 2 ton 40 mm anti-aircraft guns; contains 10 ball bearings and high quality precision workmanship, made to exacting specifications of ordnance department. Overall dimensions: 12" long x 5½" wide x 6½" high. Ship. wt. 19 lbs. Complete engineering report included. Now only **$18.95** F.O.B. Chicago



VICKERS MF9 Hydraulic Pump or Motor

Compact, powerful, rated 1,000 P.S.I., .507 cu. in per revolution. 8 gal. per min. at 3750 r.p.m. Change rotation by reversing flow. Delivers up to 6 H.P. BRAND NEW. Requires ⅓ to 6 H.P. to drive directly or by pulley. Wt. 4½ lbs. $60.00 value for . . . . . **$14.95** Postpaid

Brand New CHECK and RELIEF VALVE. Adjustable for any pressure **$2.95** post-paid

FREE: New, 20-page illustrated Hydraulic Manual featuring diagrams, photographs and instructions—FREE with each hydraulic order.

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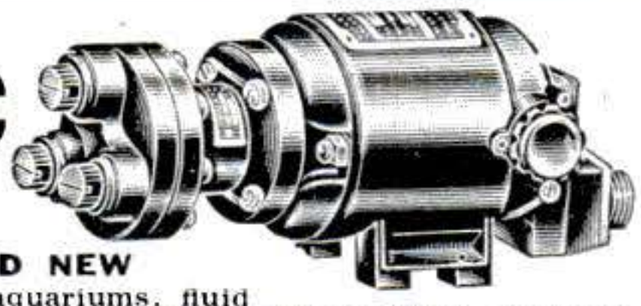
ELECTRIC PUMP



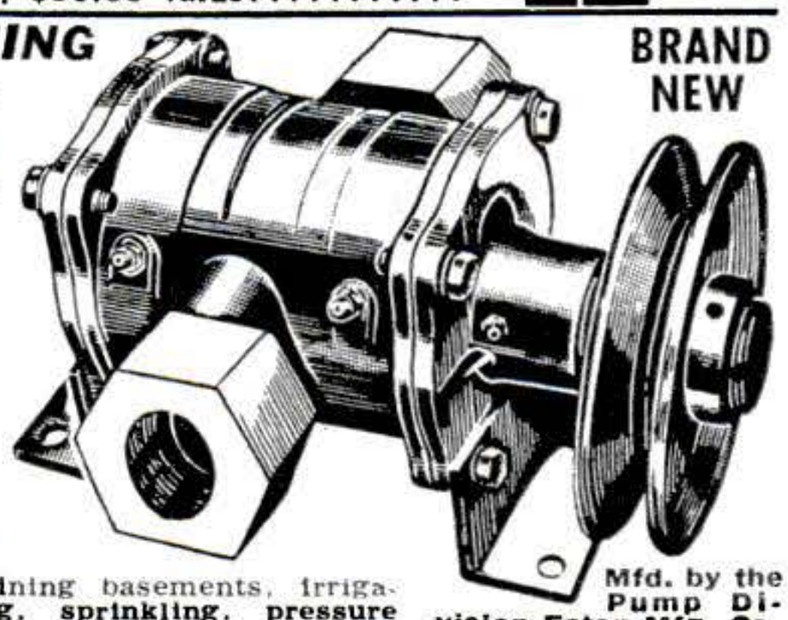
COMPACT—BRAND NEW

Applications: oil burners, aquariums, fluid metering, fuel pump, tool post grinder, coolant pump, pressure lubricating pump, general industrial, etc. **Motor mfd. by Black & Decker;** double ball bearing series wound, continuous duty, 1/30 H.P. electric motor, rated 12,000 R.P.M. Transformer included for use on 110 V AC current. Also applicable for 24-32 V DC. **Pump mfd. by Weldon Tool Co.** with standard ¼" tubing ports; rated 2 G.P.H.; remove pump and use motor as high speed grinder. **Overall dimensions:** 7¾" long x 3¼" wide x 3¼" high. Approx. wt. 5 lbs. $51.00 value . . . . . **$12.95** Postpaid

SELF-PRIMING

BRONZE PUMP

BRAND NEW



Positive Pumping Pressure

Perfect for draining basements, irrigation, fire fighting, sprinkling, pressure booster, insecticide and other spraying, fuel transfer, stock watering, industrial pumping, deep well jet pumping and home water systems. Rated 25 ft. suction and 150 ft. head pressure at 80 gallons. Use from ⅓ to 5 H.P. motor.

COMPLETE ENGINEERING REPORT AND INSTRUCTIONS FREE WITH PUMP

Supplied with mounting brackets and 5" V belt pulley, ready for instant use. Standard 1¼" pipe thread inlet and outlet. Dimensions: 9½" x 7¼" x 4¼". Ship. wt. 18 lbs. A $142.00 value . . . . . **$32.50** F.O.B. Chicago

Mfd. by the Pump Division Eaton Mfg. Co.

BRAND NEW

AIR OR OIL HYDRAULICS

● Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship.

1 **Double action, 1½" bore, 5" stroke,** will lift 1760 lbs. in one second with Vickers MF9 Pump. Wt. 3 lbs. A $35.00 value . . . . . **$8.95** post-paid

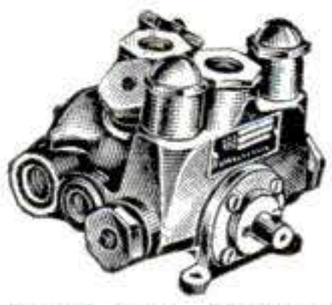
2 **Double action, 1½" bore, 9" stroke,** will lift 1760 lbs. in one second with Vickers MF9 Pump. Wt. 4 lbs. A $45.00 value . . . . . **$10.95** post-paid

3 **Use these cylinders on farm trucks,** bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Vickers Pump.) Wt. 8 lbs. A $55.00 hydraulic cylinder value for only . . . . . **$12.95** post-paid

4 **Double action, 2⅜" bore, 8" stroke.** (Will lift 4400 lbs. in one second with Vickers Pump.) Will withstand 1500 P.S.I. against wall. Wt. 7 lbs. A $65.00 value . . . . . **$14.50** post-paid

5 **Double action, 3" bore, 10½" stroke.** All steel hydraulic cylinder, will lift up to 12,000 lbs. (7000 lbs. in 3 seconds with Vickers Pump.) Complete with fittings. Wt. 12 lbs. A $78.00 value **$19.50** post-paid

6 **Double action, 3½" bore, 11" stroke.** (Will lift 9600 lbs. in 7 seconds using Vickers MF9 Pump.) Complete with fittings. Wt. 15 lbs. A $92.00 value . . . . . **$22.50** post-paid



HYDRAULIC CONTROL VALVES

BRAND NEW

1 **Four-way control valve** with built-in relief valve, for use with double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship wt. 4 lbs. A $38.00 value . . . . . **$7.95** post-paid

2 **Four way control valve** for use with two hydraulic double action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand New. Ship. Wt. 6 lbs. A $60.00 value . . . . . **$10.95** post-paid

3 **A two cylinder double action valve** with a unique arrangement allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand New. Ship. Wt. 8 lbs. A $75.00 value . . . . . **$14.95** post-paid

VICKERS HEAVY DUTY HYDRAULIC PUMP

BRAND NEW

For tractors, bull-dozers, construction machinery, lift trucks, industrial applications, etc. Used on Ross Carriers. Delivers 18 gal. per minute at 1000 P.S.I. at 1200 R.P.M. using 10 H.P. Has 1½" intake; 1¼" outlet; threaded and keyed ¾" shaft for direct or pulley drive. Wt. 40 lbs. Dimensions: 5¾" diameter, 7½" high. Original value $148.00. NOW . . . . . **$39.50** F.O.B. Chicago

VICKERS HEAVY DUTY HYDRAULIC CONTROL VALVE

Brand New. This Vickers heavy duty 4-way control valve, Part C-2330, is ideal for use with the Vickers Heavy Duty Pump for double action cylinders. Has built-in relief valve with 50 to 1000 lbs. per sq. in. overload adjustment; max. capacity 24 GPM; pressure inlet connection from pump ¾" pipe thread; cylinder connections ¾" pipe thread; discharge connection to tank 1¼" pipe thread; Over. dimen.: 8¾"W x 10⅞"L x 7⅝"H. Ship. wt. 54 lbs. ORIGINALLY COST MANY TIMES MORE. NOW . . . . . **$24.95** F.O.B. Chicago

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SAVES TIME—SAVES "ELBOW GREASE"

Here's a machine that takes the hard work out of two tough jobs . . . sanding and polishing. **"Moto-Sander"** is so easy to handle that a child can use it . . . so fool proof that, with it, even a novice can do a craftsman-like job. **Moto-Sander's** fast, straight-line action (non-rotary) eliminates any possibility of wood burns or scratches. Does a magically smooth job of sanding . . . gets into corners and places others can't reach. All **you** do is guide it! There are dozens of time and moneysaving uses in every home and shop for this inexpensive machine. Use **Moto-Sander** to get smooth sanded finish on furniture, painted walls, boats, bird houses, scale models, etc. Use it also for speedy, effortless **polishing** of waxed furniture, automobiles and other surfaces—simply by removing sandpaper and clamping on polishing pad. **Moto-Sander** is the lightest, most practical electric sander on the market—**the only one of its kind.** Furnished with 6 assorted sheets Garnet paper for sanding . . . plus **felt pad** and **sheepskin** for wax polishing. Operates on alternating current. Thousands of satisfied users.

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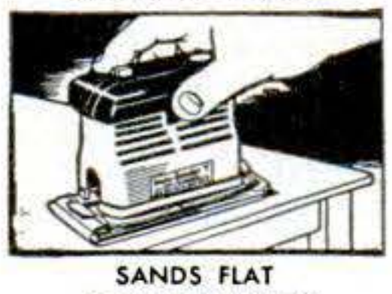
SANDS FLAT SURFACES EVENLY

GETS INTO TIGHT CORNERS

ROUNDS CORNERS LIKE MAGIC

USE MOTO-SANDER AROUND THE HOUSE

- **Sand Furniture and Woodwork**
- **Polish the Family Car**
- **Sand Walls before painting**
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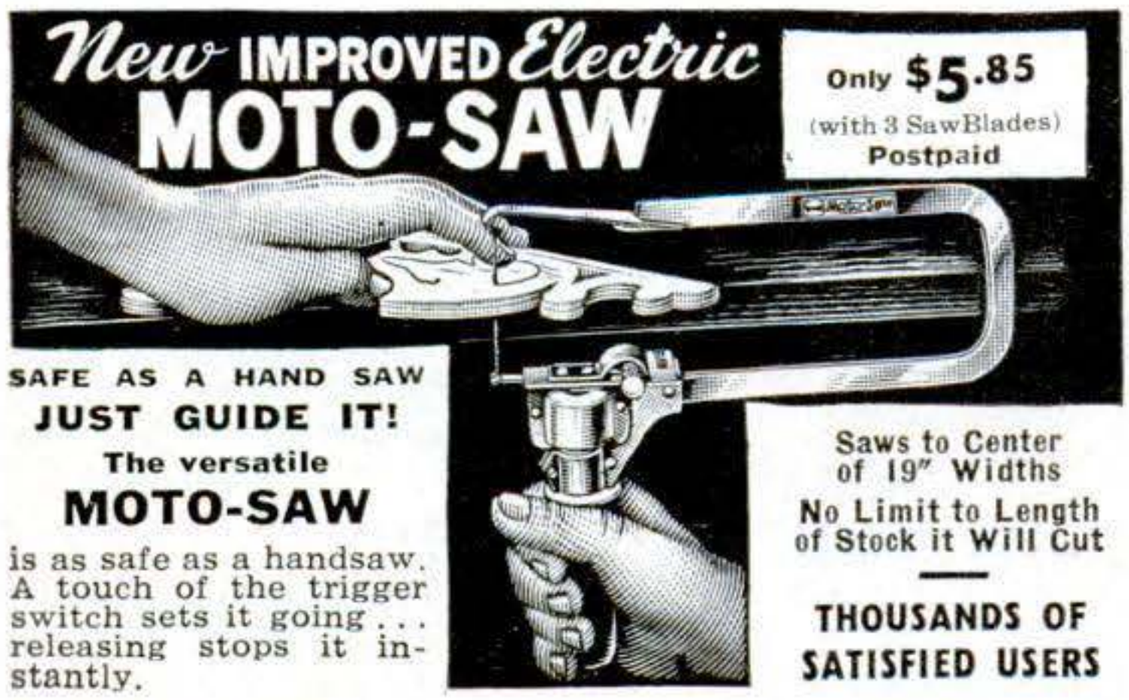
MONEY-BACK GUARANTEE: Buy Moto-Sander from your dealer. If he cannot supply you send only **$14.85** (check or money order) and we will ship postpaid; or, send only **$2** now, and pay postman balance plus postage upon delivery. Your MONEY-BACK if not delighted after 5 days' trial.

DREMEL MANUFACTURING CO.
Dept. SP129-B • Racine, Wis.

New IMPROVED *Electric* MOTO-SAW

Only **$5.85** (with 3 SawBlades) Postpaid



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JUST GUIDE IT!
The versatile MOTO-SAW
is as safe as a handsaw. A touch of the trigger switch sets it going . . . releasing stops it instantly.

Saws to Center of 19" Widths
No Limit to Length of Stock it Will Cut

THOUSANDS OF SATISFIED USERS

AVERAGE CUTTING SPEED ONE FOOT PER MINUTE

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The "Pocket-Size Machine Shop"

HIGH-SPEED STEEL CUTTERS —AT NO EXTRA COST

No modern home workshop is completely equipped without MOTO-TOOL . . . the **correctly balanced** motor-in-hand tool. It grinds, drills, routs, carves, polishes . . . **without vibration.** Higher speed does work better, faster, on practically any material. MOTO-TOOL Kit No. 2 includes **high-speed-steel cutters** for longer life, better work. MOTO-TOOL is backed by over 12 years of industrial use . . . packs years of pleasure. Due to wide popularity and increased production, **Dremel's pre-war prices still prevail!**

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$16.50

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With 23 Accessories (High-Speed Steel Cutters, Grinding Wheels, Polishing Accessories)
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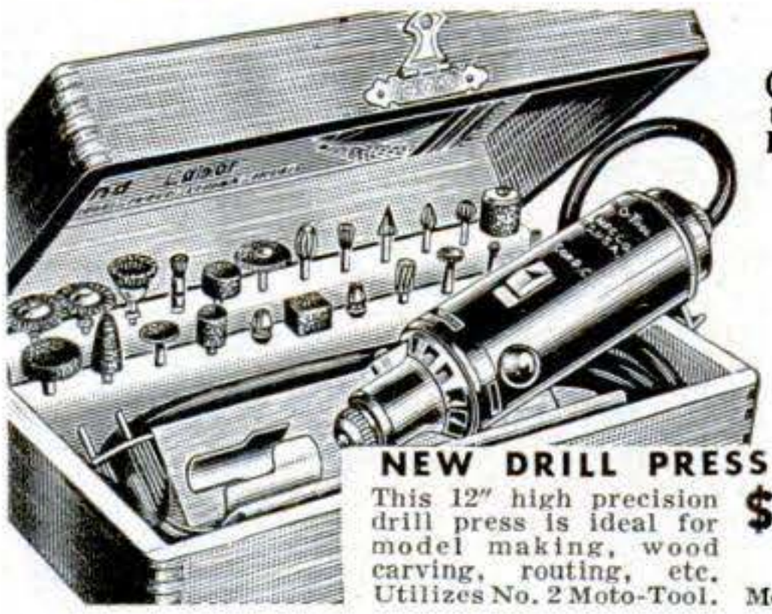

NEW DRILL PRESS—only $9.95
This 12" high precision drill press is ideal for model making, wood carving, routing, etc. Utilizes No. 2 Moto-Tool. (Less Moto-Tool)

Look for These Moto-Tool Features

Approximately 27,000 R.P.M. plus dynamically balanced armature provides vibrationless finger-tip control. Moto-Tool has oilless, sealed bearings • Patented automatic chuck lock pin • Over-size armature shaft—hardened, ground, polished • 110 Volt, AC-DC motor • Sliding snap-type switch • Cord protector • Shockproof bakelite housing • Dust-filtered aircooling system • Weighs only 13 oz.

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EASY TO ASSEMBLE KITS

Everything Complete in Kit. Quality Material. Simple as ABC instructions. Immediate Delivery.

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Colorful Illustrations show all '49 Models, 8 to 23 Ft., and Construction Details.

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by CUMMINS

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THE WEIGHT'S ON THE WORK AND YOU SEE WHERE YOU SAW

FOR BUILDERS... FARM...FACTORY... HOME SHOP. TESTED, PROVED... MOST PRACTICAL, BETTER BUILT!

Only BALANSAW combines the two features you want—*Balance* and *Visibility*. With Balansaw, the weight helps do the work instead of dragging on your wrist. And you sight this saw right on the line you're cutting; an internal blower clears the cut of sawdust. Users call it the world's sweetest operating saw, and so will you!

Finest Construction! READ: 6-in. combination blade, 1⅞ in. in the wood. Blades for flooring and transite available. Steel base adjusts instantly for depth of cut. Die cast aluminum alloy frame. Automatic safety guard. Heavy duty switch. Precision alloy steel worm, navy bronze gear. Impeller-cooled. Anti-friction N.D. ball and roller bearings. 12-in. overall, wgt., 11 lbs. Try BALANSAW at dealer's or mail coupon. You'll agree it's the easiest, surest saw you ever used!

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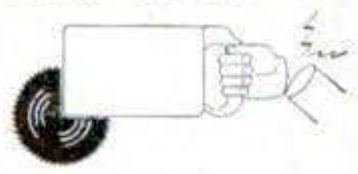


Unbalanced. Breaks Your Wrist.

NOT THIS:

Somewhat Balanced. But You Can't See What You're Doing.

INSTEAD:

Visibility and Balance.

EASY ON THE WRIST

YOURS FOR LIFE!

Your BALANSAW needs never be replaced; it is PERPETUALLY Guaranteed by Cummins, Precision Manufacturers since 1887.

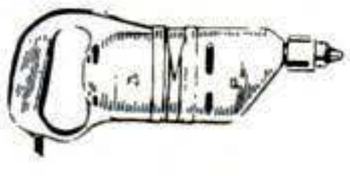
THE C LINE SINCE 1887

Full Line of Standard and Light Duty Drills.

• Balansaw Trade Mark Registered U.S. Patent Office

ALSO "C-LINE" DRILLS *PERPETUALLY GUARANTEED!*

No. 200 (½-in.) $43.75
Jacobs Geared Chuck. Standard Duty.



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Greenlee 22

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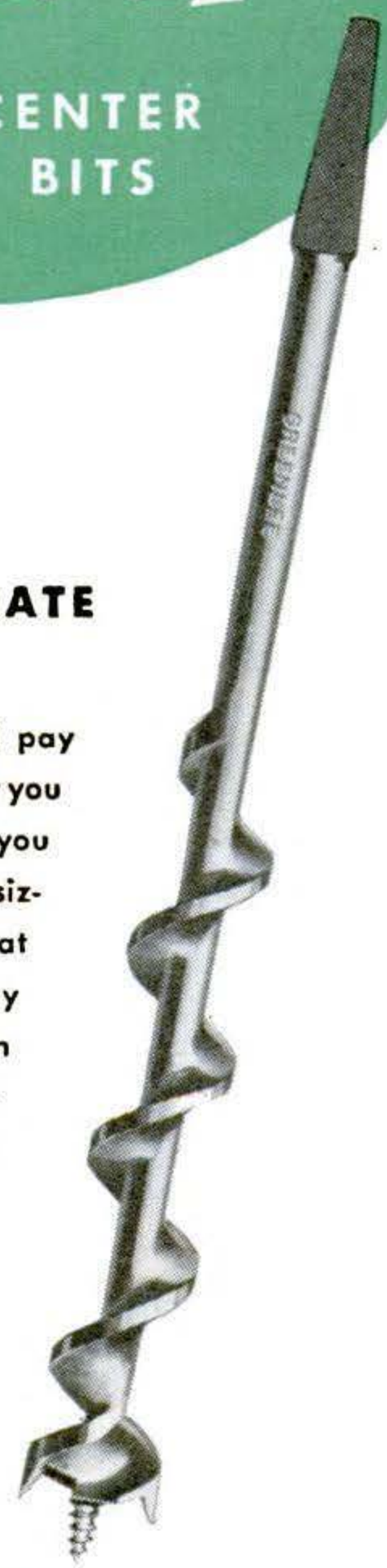

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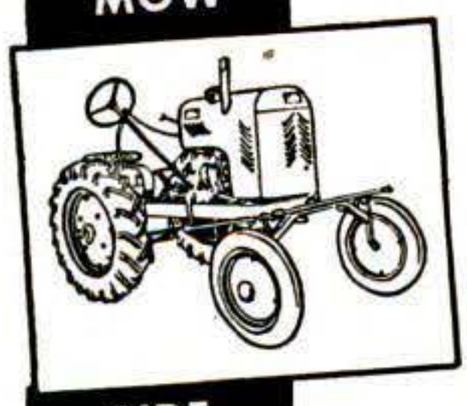

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Shaw Du-All or Peppy-Pal tractors do many jobs quickly and easily. Plow, cultivate, harrow, mow, disk, bulldoze, spray, grind, haul and saw wood. New uses discovered every day.

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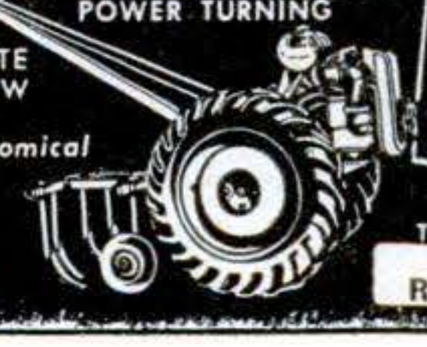

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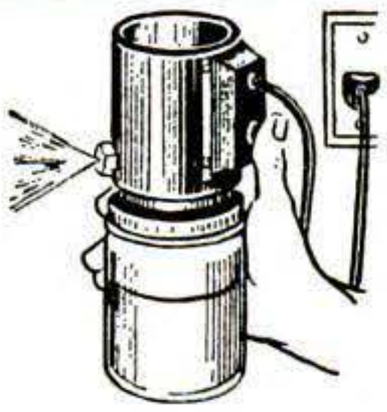

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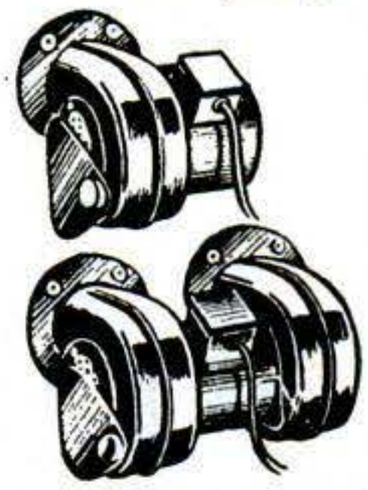

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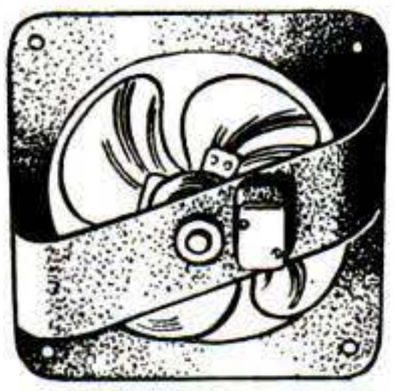

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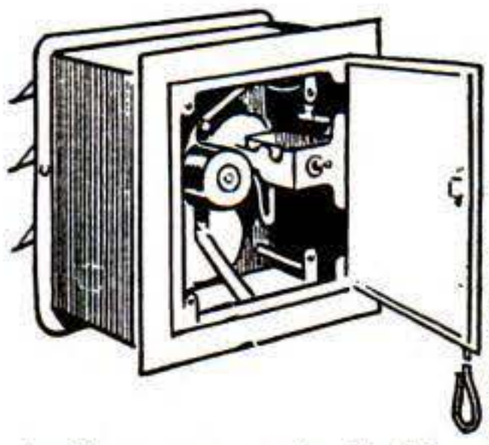

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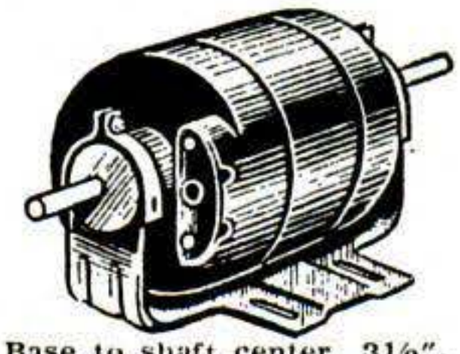

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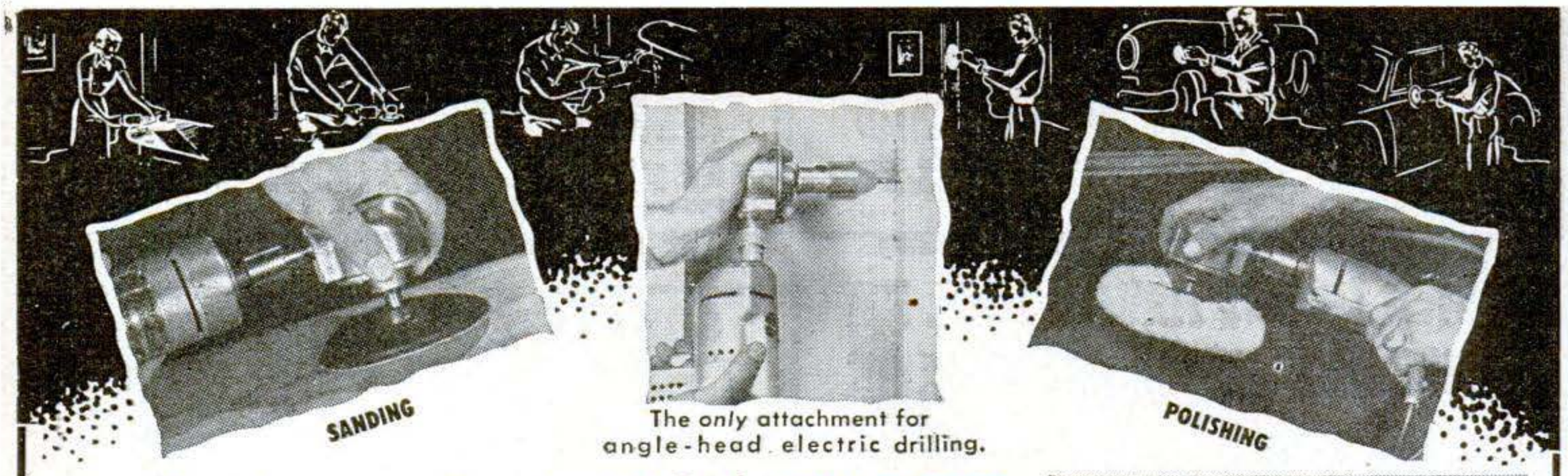

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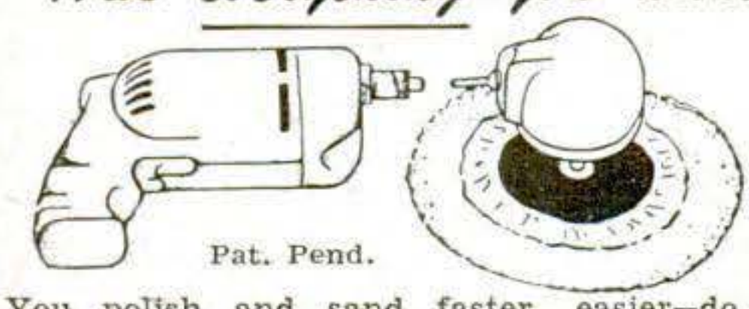
Has everything you want in a polisher-sander!



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**See description under photo of Bull Buffer kit.*

Bull Buffer comes complete with sheepskin bonnet and two sanding discs, only $9.95. Bull Buffer alone cuts drill speed ½; for direct drive (or same as) drill speed, order Adapter A with Bull Buffer; for twice drill speed, order Adapter B.

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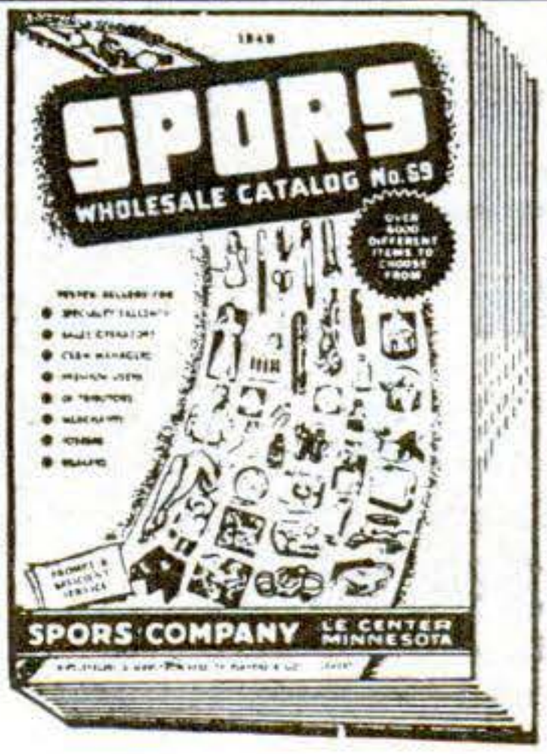

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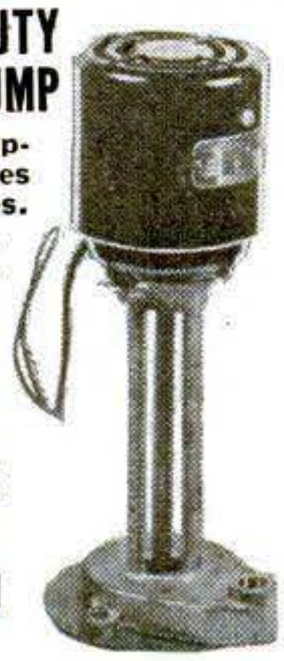

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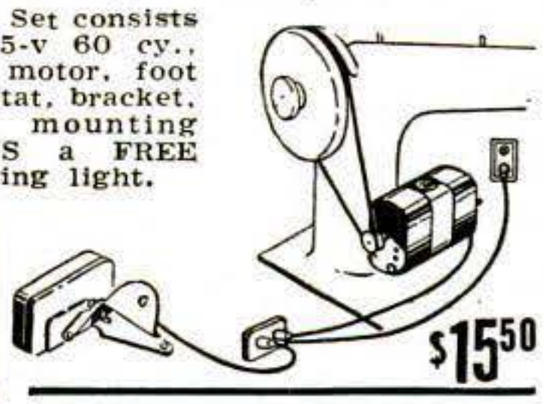

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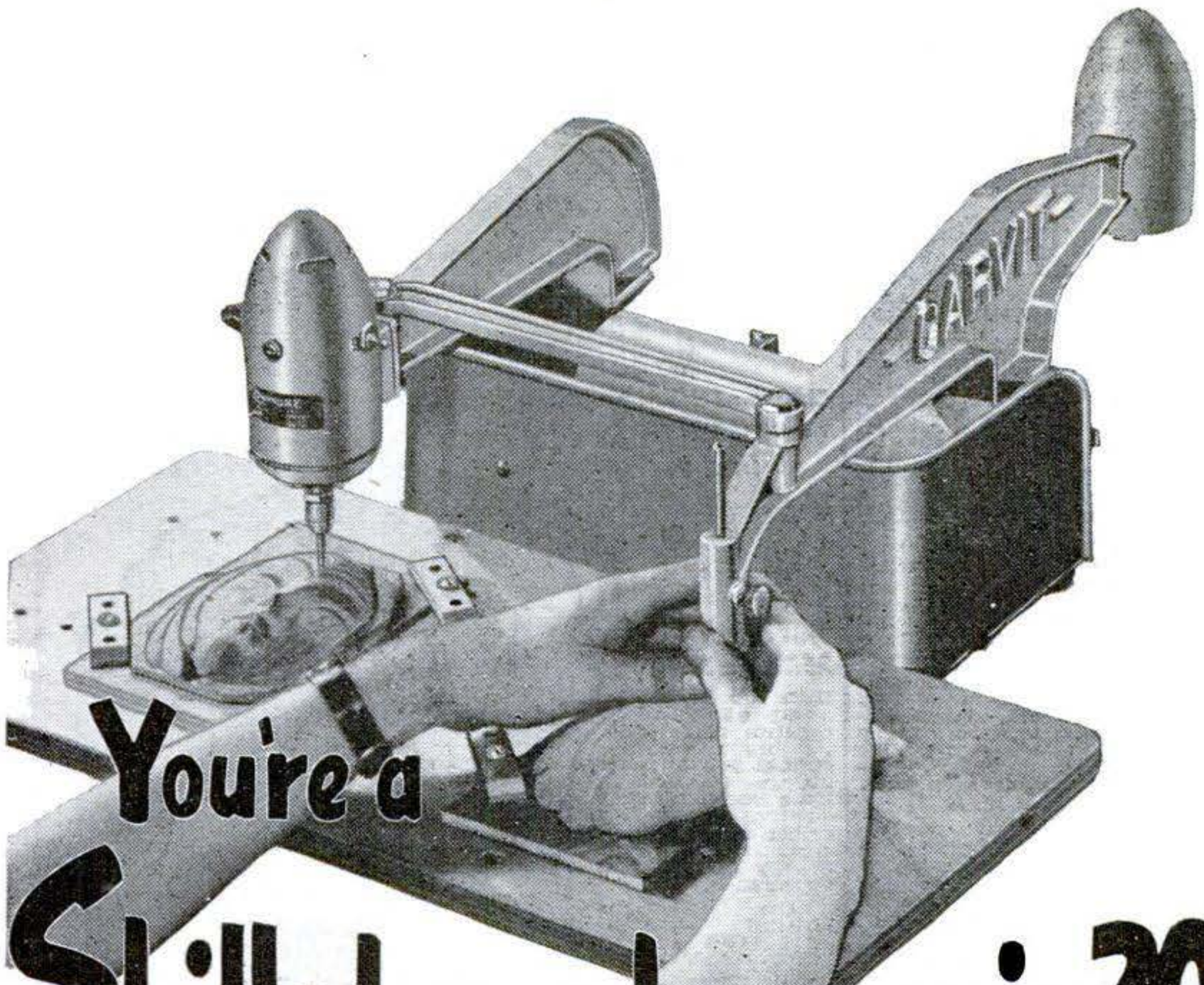

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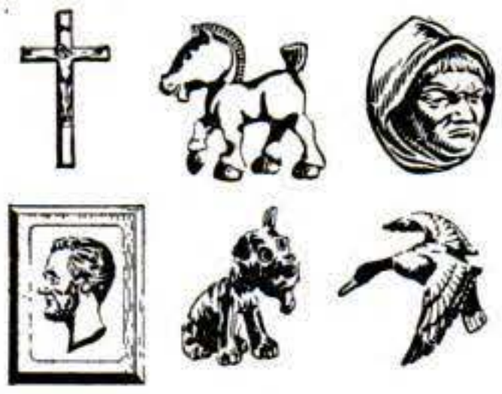

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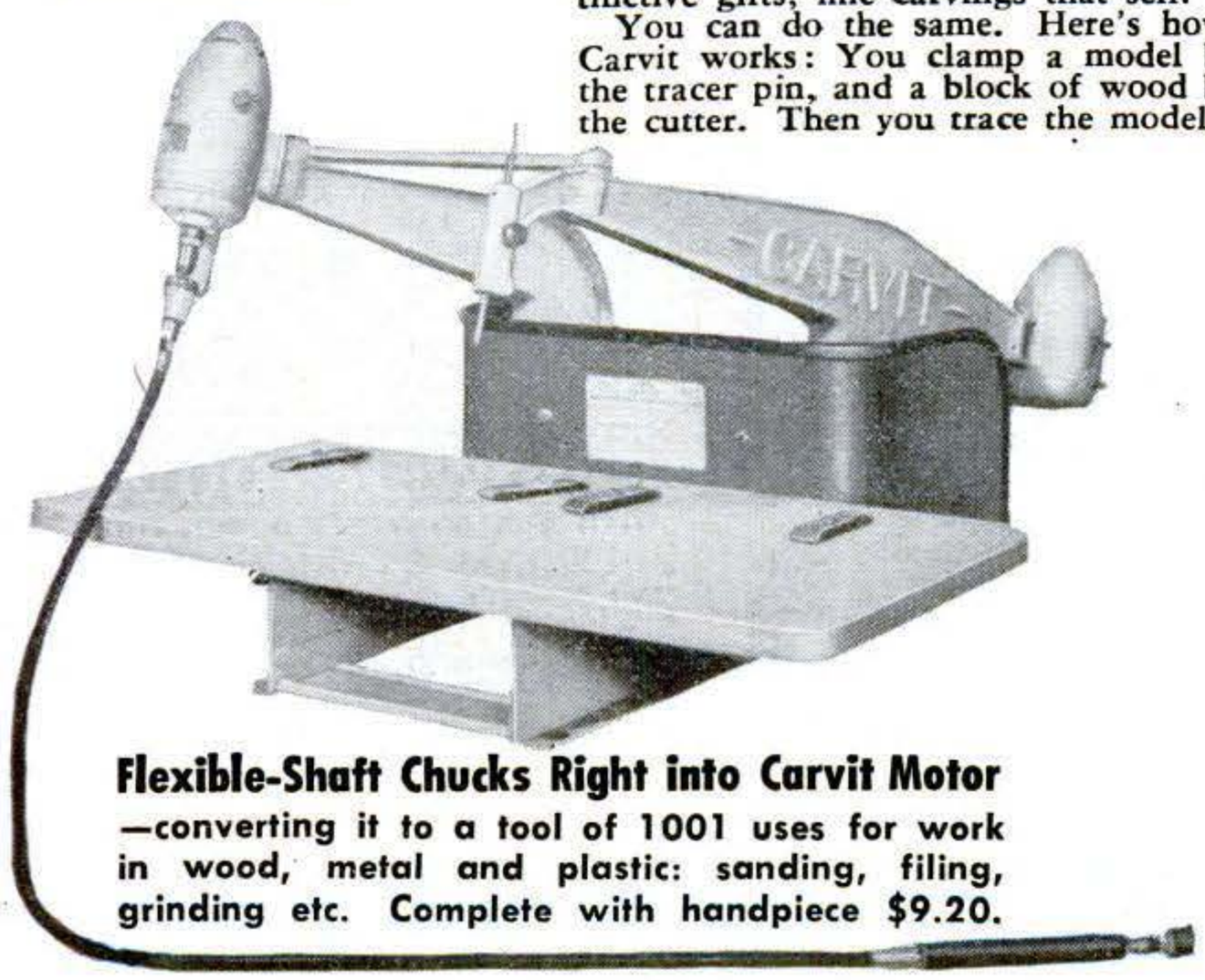
Attachment makes your Carvit a Flexible-Shaft Machine.



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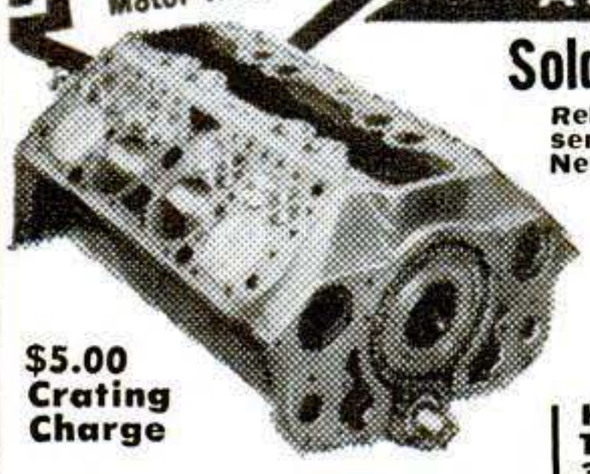

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We ship at outright price. Send your motor prepaid, must be suitable for rebuilding. Send in notarized bill of sale showing title number if any. We refund difference when we receive your motor.

$5.00 Crating Charge

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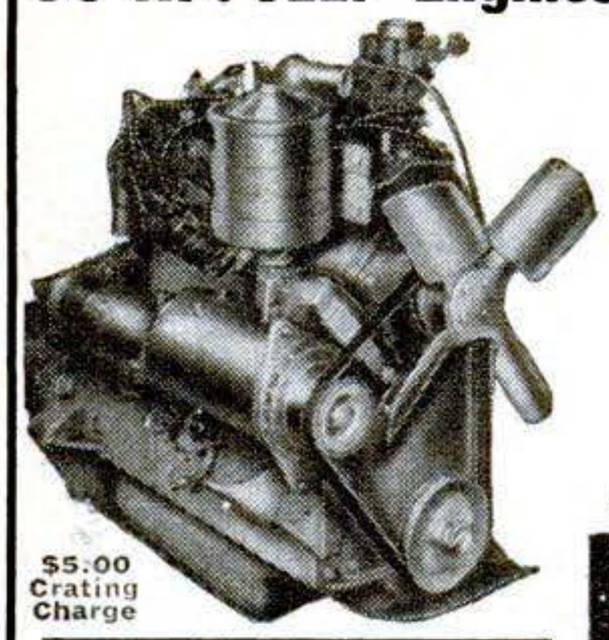

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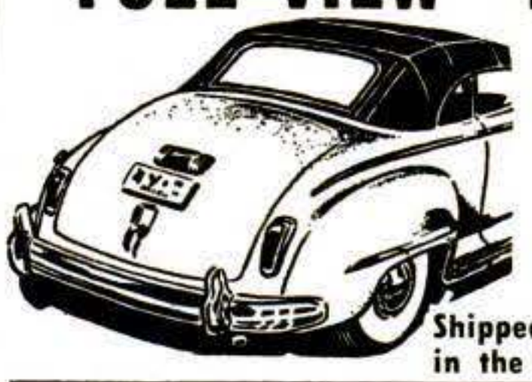
for Convertible Cars only



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DODGE	1935-38 . .	33.00
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1928-31 Roadster & Cpe.		24.95
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Car	Year	Price
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LASALLE	1936-40 . .	41.75
MERCURY	1939-42 . .	37.95
MERCURY	1946-49 . .	39.95
NASH & LAFAYETTE	1937-41 . .	39.95
OLDSMOBILE	1936-48 . .	41.75
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STUDEBAKER	1948 . .	44.15

NOTE: Specify color wanted also Model or Series, Body Style, Year & Make when ordering.

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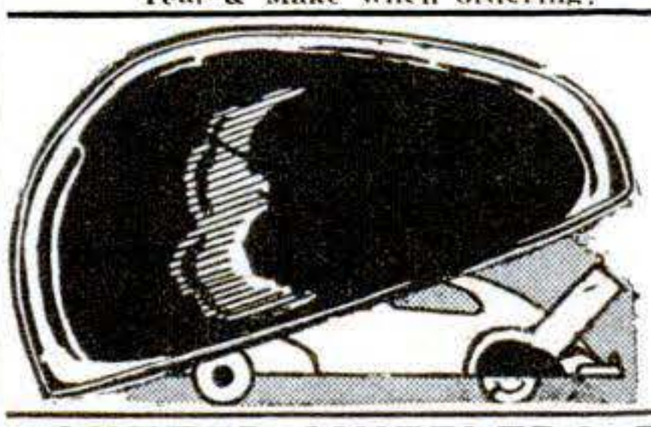

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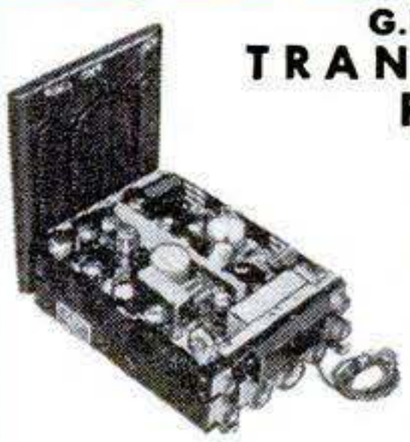

No. 201. Beautiful 15 tube transmitter - receiver. Operates in new citizens band 460-470 Mc. Supplied new in original G.E. sealed cartons with 15 tubes (tubes worth over $40.00) and conversion instructions to operate between home and car, boat, office, etc. Only a limited number available. Order early. Shipping weight 25 lbs. each.

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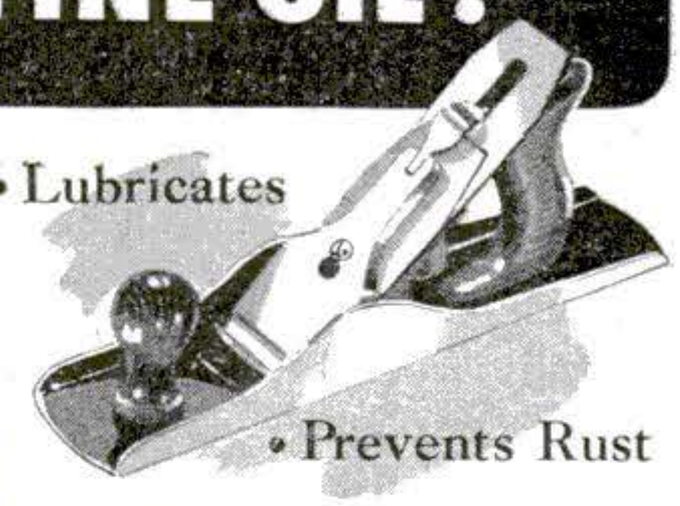

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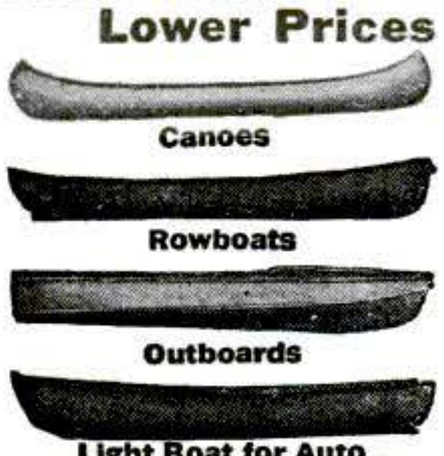

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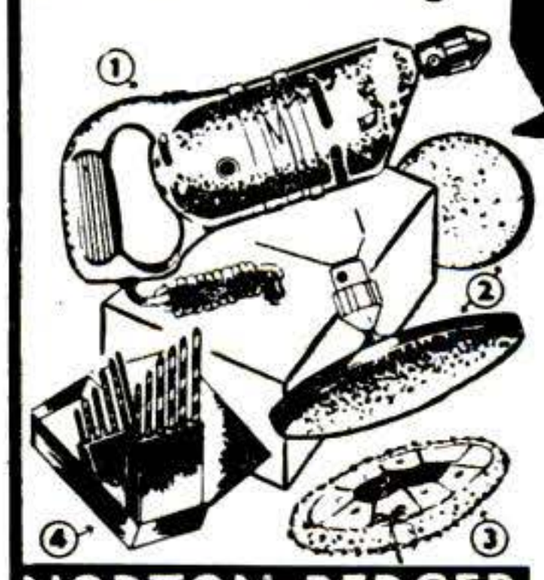

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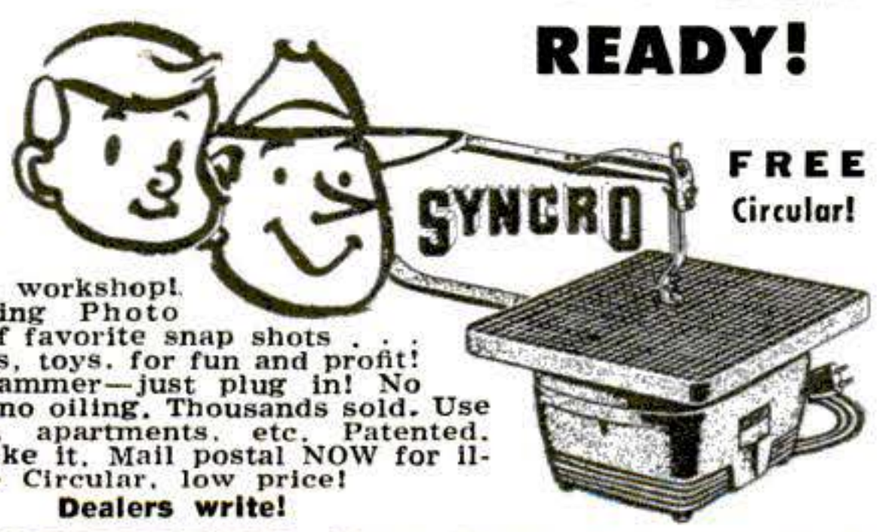

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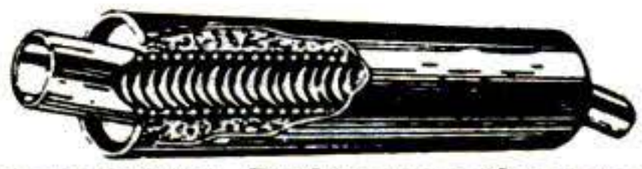

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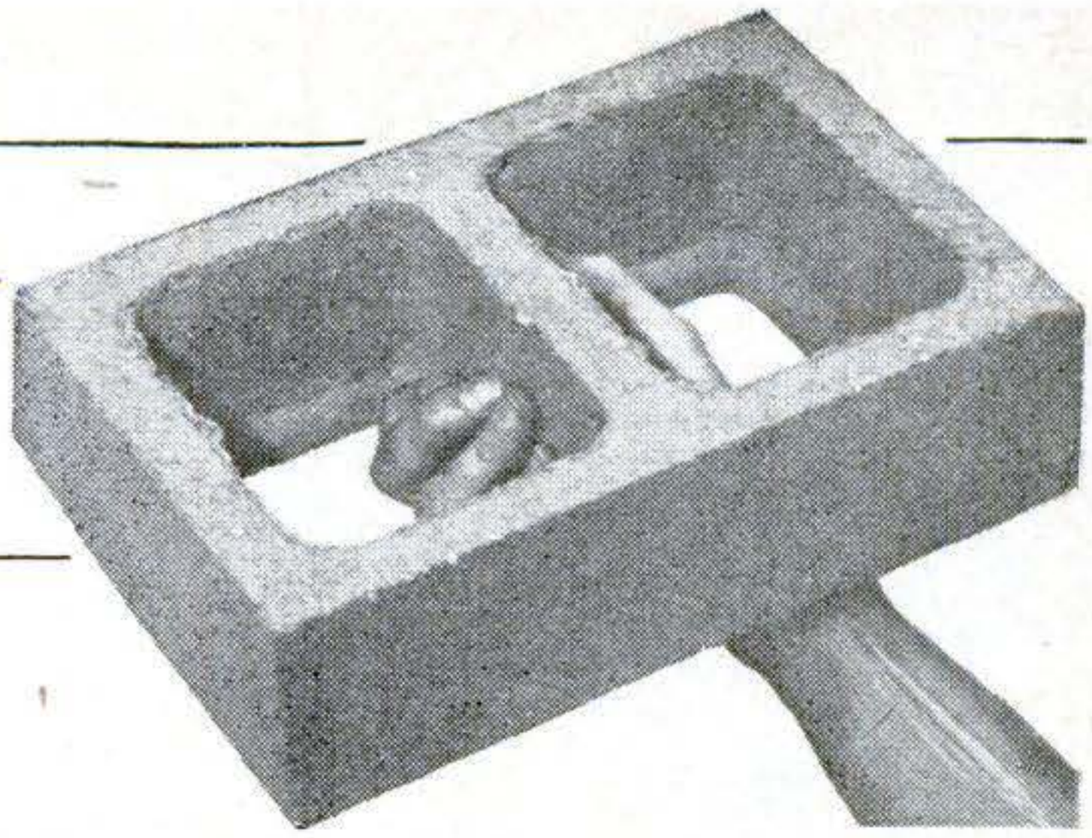

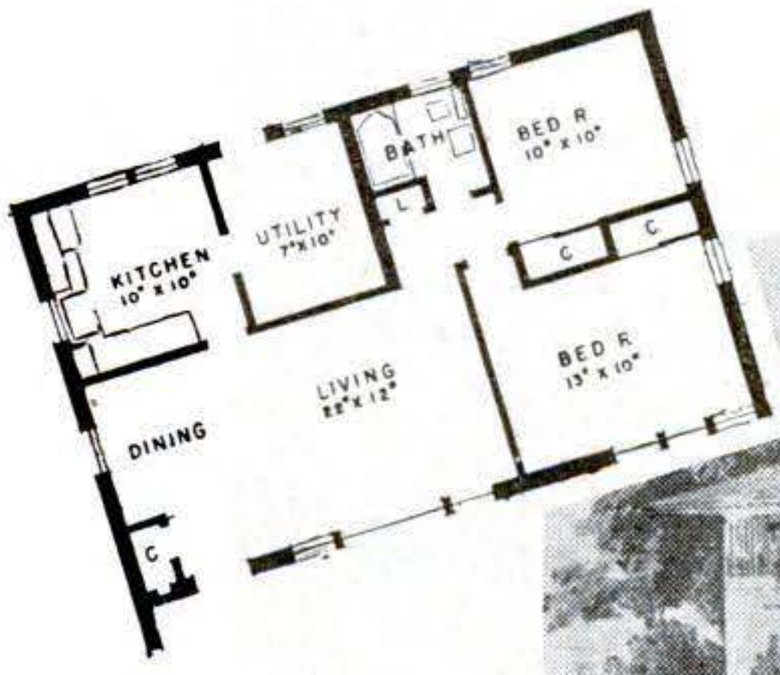

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Two sizes: 8x12x3½; 4x12x3½ (laid up). Half and corner units for each size.

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Self-contained insulation values because of a 43% void.

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Standard colors include reds, buffs, browns, tan, making possible dozens of different color effects. Pastel shades for interior walls.

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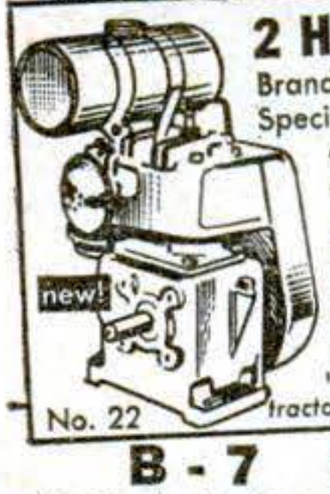

Brand new! Mfd. by General Engine Corp Specifications: 4 cycle, single cylinder, air cooled, rope starting Completely equipped with oil cleaner, fuel filter, dust proof magneto, gas tank, muffler, etc. Finest utility engine made. At ½ the regular price! In original govt. case. *Excellent for operating saws, pumps, generators, bench tools, sprayers, garden tractors, etc. Ship wt 37 lbs. Shipped express collect.*

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2 pc. suit with parka hooded jacket and cover-all bib-style pants. OD color. Waterproof, windproof, -lightweight, plastic resin-coated fabric. Pants have zipper fly, button flap, pocket. Sizes, Med., Lge., Ex Lge. *For sportsmen, hunters, fishermen.*

2 pc. suit $6.88

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Precision compass by "Sherrill." Easy to compensate. Equipped with nite lite, excellent for planes, cars, boats, trucks, etc. Easily mounted. Instruction manual and calculator included. $37.50 value. New!

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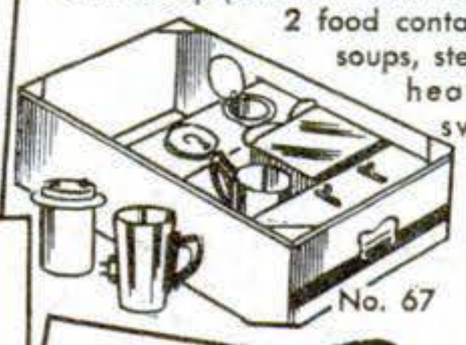


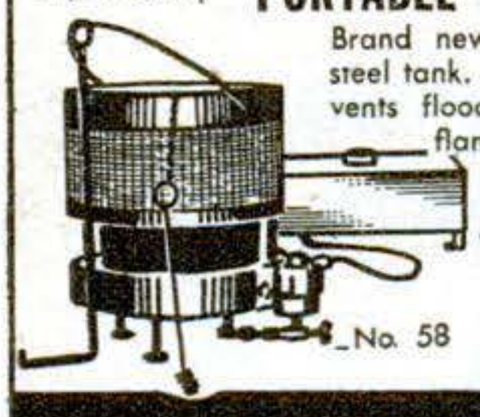
With electric cup **$19.50**

Without elec cup **$12.95**

NEW

PORTABLE GASOLINE HEATER

ship wt 36 lbs.



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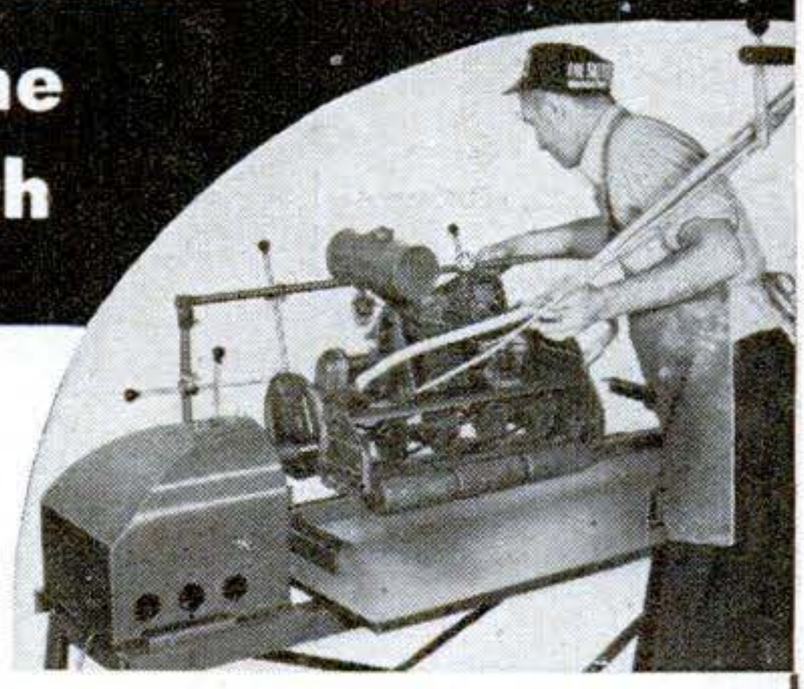

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Send FREE PLAN on the Foley Lawn Mower Sharpening business.

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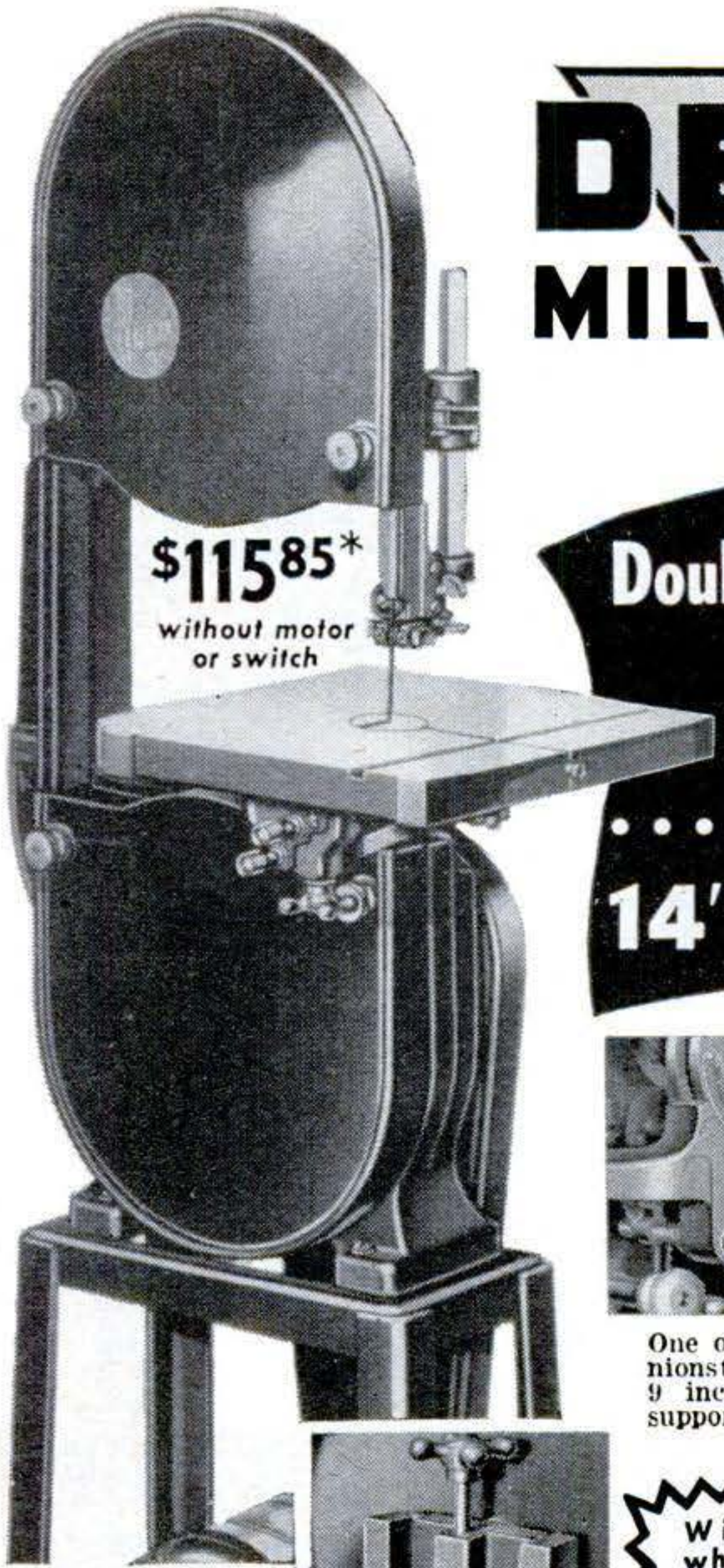
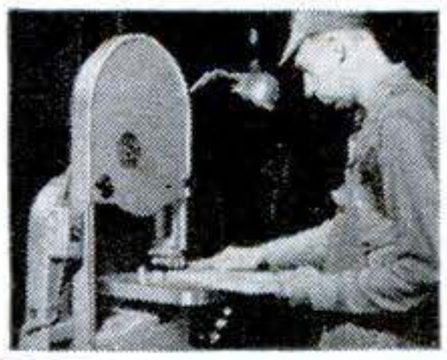
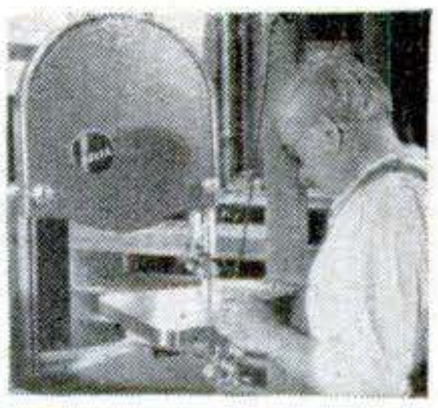


DELTA MILWAUKEE®

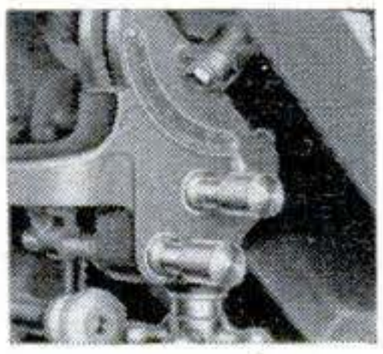
Delta-Milwaukee 14" Band Saws can be found in shops of all kinds — wherever accurate cutting must be done easily and economically.





Hobbyists who want the best in power tools equip with a Delta-Milwaukee 14" Band Saw.

Double table-supports help you get greater accuracy—even on big, heavy work ...with a DELTA-MILWAUKEE® 14" Wood-cutting Band Saw



One of the 2 trunnions that are spaced 9 inches apart to support table.

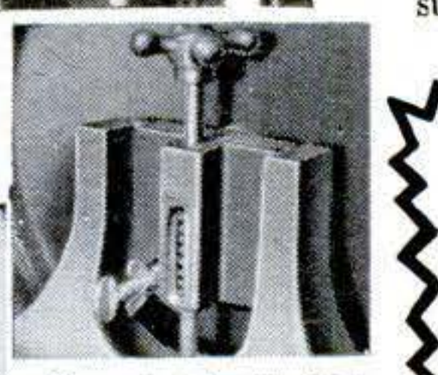
Cuts wood, felt, corrugated board, paper, other materials

Two trunnions — widely spaced — one on either side of the blade — support the table of the Delta-Milwaukee 14" Band Saw. This gives you a steadier surface to work on. The table stays rigid, at any angle. You're able to saw more accurately.

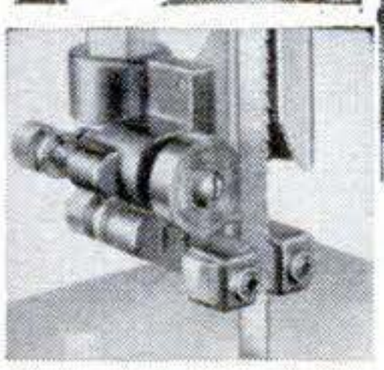
That's only one reason why this Delta-Milwaukee machine is first choice of those who know fine tools. There are many other quality construction features:

- Ball bearings are used, giving trouble-free performance — and they are lubricated for life.
- The table is big — 14" x 14". It has a 3/8" x 3/4" miter-gage groove. Tilts 45° right and 10° left.
- Blade guide controls can be adjusted safely at the front of the table.
- Aluminum wheels are carefully balanced, so that the blade is true-running.
- Upper and lower wheels are completely guarded, to protect you. Guard covers saw blade at rear; sliding guard covers all but working surface of blade in front.
- Rip gage is available for ripping.

Have your nearby Delta distributor tell you more about these features for safety, accuracy, economy, and convenience. Inspect the Delta-Milwaukee 14" Band Saw there now — and see his *complete* Delta-Milwaukee line.



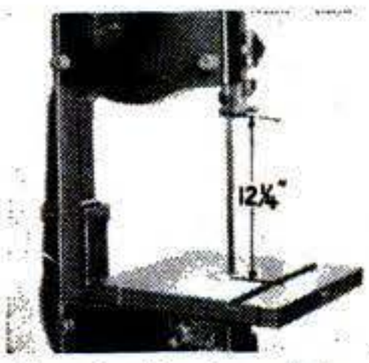
Upper wheel has blade-tension adjustment. Index shows correct tension for various widths of blades.



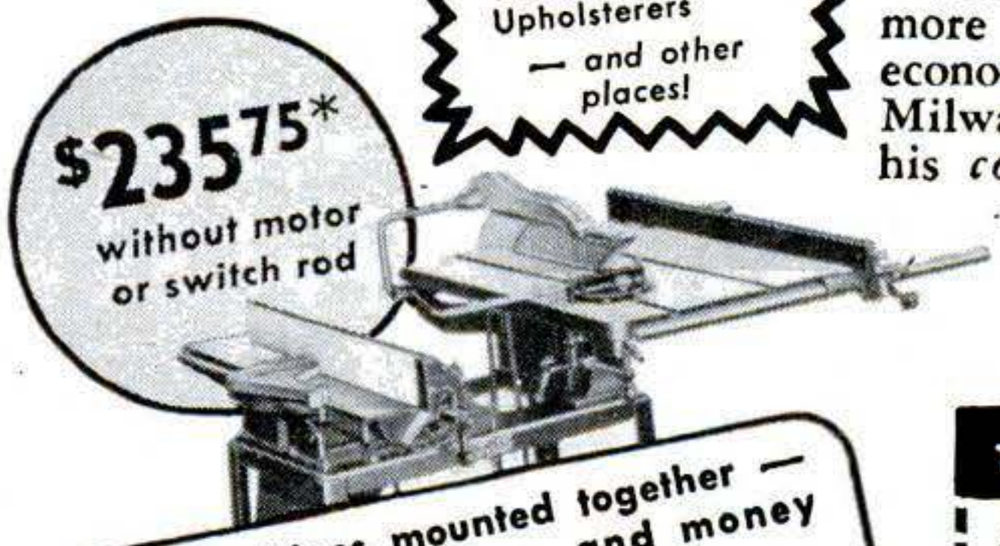
You can independently adjust blade guides and blade supports with micrometer accuracy.

Widely used wherever folks insist upon highest-quality tools:

Cabinet Shops
Carpenter Shops
Display Shops
Furniture Factories
Home Workshops
Hotels
Pattern Shops
Sign Shops
Theatres
Upholsterers
— and other places!



Simple attachment increases capacity from 6¼" under the guide to 12¼". Can be added any time.



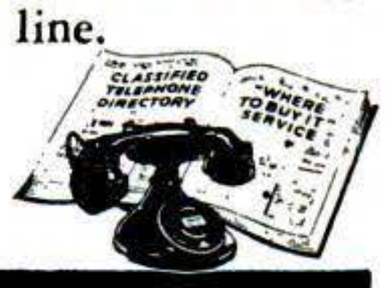
Two machines mounted together — to save space, time, and money

DELTA-MILWAUKEE SAW-JOINTER COMBINATION

Circular saw and jointer mounted on one steel stand and driven by same motor. Both may be operated singly or together. 10" circular saw cuts 3¼" stock. Rips to center of 50" panel. Jointer surfaces boards 6" wide; cuts rabbets ½" deep. Both tools have lubricated-for-life ball bearings. See this dual-purpose machine at your Delta distributor.

Send for free catalog!

Look for the name of your Delta distributor under "Tools" in the classified section of your telephone directory.



*Prices subject to change without notice

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-and MILE-MASTER Fuel Tank

Mile-Master Fuel Tank (16 lbs.) goes anywhere in boat!

AT LAST! A new *kind* of outboard motor with gearshift control—long cruising range—flashing acceleration—10.0 full horsepower* (yet it trolls!)—little weight (only 56 lbs.!)... Neutral-Forward-Reverse, Mile-Master Fuel Tank, Calibrated Carburetor, Vari-Volume Pump, Lubri-Tite Seals—new, every one! And many other features—40 in all!

NOW IN PRODUCTION! Look for your Johnson dealer's name under "Outboard Motors" in your classified telephone directory. See him soon!

*10.0 O.B.C. Certified brake H.P. at 4000 r.p.m.!

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JOHNSON SEA-HORSES *for DEPENDability*

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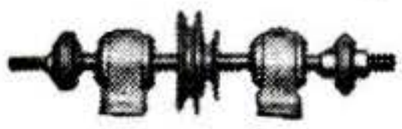
Mercury centrifugal clutch for use with any small gas engine. 3" "A" belt pulley, 5/8" bore. **Stock #400. Brand new . . . . only $9.95**

BALL BEARING ARBORS



Grinding and saw arbor, has 1/2" double end shaft, 11 1/2" long with 2" center pulley. New Departure double roll ball bearings. Right and left hand thread. Self aligning Dodge pillow block. 10,000 RPM. Bearings alone list at $10. Complete arbor new. **Stock #305 . . . . . only $4.95**

HI-SPEED GRINDER (not pictured). Has 2 step pulley driven thru rear or base. **Stock #328 . . . . . $10.95**

ELECTRIC RUBBER CABLE

(all new)

CORD SETS

Extension cords, 100 ft. heavy duty. Plug, socket and guard. Number 16 wire. Worth at least $10. **Stock #310. OUR PRICE $5.35**

Same as above — 50 ft. length. **Stock #311 . . . . . $3.85**

Heavy Duty Electric Cable

3 wire #10 rubber Tyrex cable—with lugs. 65 ft. lengths. **Stock #345, NEW $13.00**

3 wire #10 submarine cable and lugs—can be placed underwater, underground or overhead. Also for portable tools. Will carry 40 amps. **Stock #312.**

50 ft.	100 ft.	250 ft.	500 ft.
$12.00	$20.00	$45.00	$85.00

4 conductor neoprene covered # 18 stranded tinned copper wire (two blacks & two whites). Run in parallel gives you #16 gauge. Lugs furnished for parallel run. Water & oil resistant. **(Stock #346)**

100 ft.	250 ft.	500 ft.	1320 ft. reel
$4.25	10.00	$19.00	$36.00

150 ft. reels, 3 wire #6 with 4, 60 amp Crouse & Hines connectors—2 male & 2 female. Perfect for welders, hay loaders, saws, electric ranges, etc. List price $190 per reel. **Stock #313. OUR PRICE $65.00**

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8" ball bearing fan Mfg. by Robbins & Meyers. Can be run vertically or horizontally. 110 volt AC 60 cycle motor with plug and cord. New in original box. **Stock #401 . . . . . only $11.95**

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"Assembled or in kit form"

Stock #332

Heavy duty wagon with plate aluminum body 24" x 42". 5/8" steel axle with ball bearing wheels. Heavy rubber tires. Ideal for newsboys, farms, grocers, parts dept., etc. Approx. wt. 88 lbs. Nothing like it now on the market.

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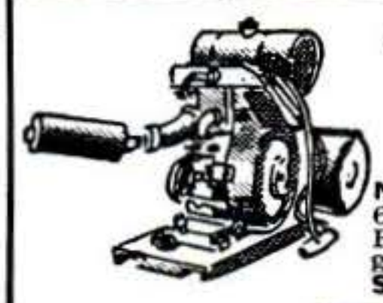


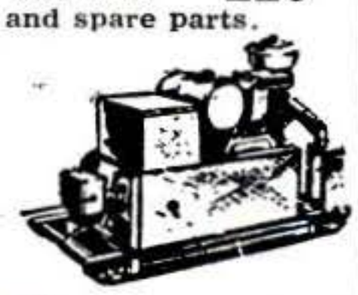
AC ARMY LIGHT PLANTS

New 750 watt 110 volt, 60 cycle light plant with Briggs-Stratton model AP gas engine. **Stock #315. $149.50**

New 1000 watt 110 volt, 60 cycle light plant with Briggs-Stratton model BP gas engine. **Stock #316 . . . . . $179.50**

New 2500 watt 110 volt, 60 cycle light plant with Briggs-Stratton model Z 6 HP gas engine. **Stock #317. New $265.00** **Used,** like new **$225.00**

Add $10 for tools and spare parts.



Rebuilt 5000 watt 110 volt, 60 cy. light plant with automatic remote control. Powered by Jeep 4 cyl. gas engine. Rebuilt like new and guaranteed. **Stock #318 . . . . $ 625.00**

7,500 watt, 110 volt AC light plant powered by VE-4 Waukesha 4 cyl. gas engine. Continental or Hollinsworth generator. Remote control starting with 100 ft. starting cable, and 100 ft. of 3 wire #6 cable. Complete switch board. Used, like new. **Stock #347 . . . . . $675.00**

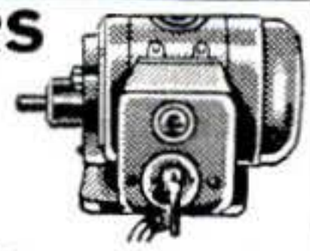
Add $65.00 for transformer to make plant 3 phase, 220 volt.

10,000 watt 110 and 220 volt, 60 cy. light plant with automatic remote control. Powered by Jeep 4 cyl. gas engine. Rebuilt like new and guaranteed. **Stock #319 . . . . . $900.00**

PORTABLE DC LIGHT PLANT

3000 watt 110 volt DC powered by new 6 HP Briggs-Stratton model ZZP gas engine. Rebuilt generator. Generator alone lists at $243.00. Has volt meter, rheostat, 4 female plugs, and ball bearing 2.75 x 10 rubber wheels. Guaranteed. **Stock #320 . . . . . only $185.00**

GENERATORS



DC—3000 watt, 110 volt. Has voltmeter, rheostat & 4 female plugs. Lists at $343. **Stock #321. OUR PRICE. $75.00**

AC—750 watt 110 volt 60 cy. with voltmeter, rheostat, 3/4" shaft. Dimensions: 9"H x 12"W x 13"L. Wt. 52 lbs. Shielded to prevent radio interference. Mfg. by Eicor. $125.00 value. **NEW. Stock #322. OUR PRICE $59.50**

AC 1000 watt— Stock #403 . . . . . $69.50

DC-300 watt, 12 volt, 2900 RPM, heavy duty, with current cut-out relay, high and low switch, 30 amp meter. Can be bought less shaft and base to be used direct mounted to Briggs-Stratton 1 HP engine. **NEW. Stock #323 . . . . . $7.00**

Complete with base, shaft and bearing. **NEW. Stock #324 . . . . . $15.95**

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Motor driven, (not a vibrator). Heavy duty with great power and long life. Adjustable for high, medium or low tone. 110 volt AC current. Weather proof. For alarm or signal horn on boats, school yards, factories, etc. List price $47.00. **NEW. Stock #302. OUR PRICE $9.45**

Portable

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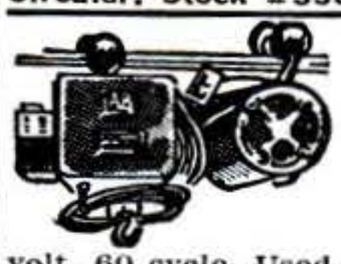
Powered by 6 1/2 HP Briggs & Stratton air cooled gas engine. Adjustable hinge, requires no clutch. 28" blade, will take up to 12" hardwood. 1 3/8" ball bearing mandrel. Has power take-off. Complete unit mounted on two wheels with 400 x 8 pneumatic tires. Has tow bar for trailing. Wt. approx. 400 lbs. Sold complete or less blade, engine or wheels. Make $25 to $50 a day sawing wood with this sturdy unit. **Write for free Circular. Stock #350.**



Electro-lift HOIST

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Specify 220 or 440 volt

Automatic

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Complete, piston type with 10 gal. tank, 1/3 HP capacitor type, AC, 110-220 volt 60 cycle motor. V-belt drive. Will develop 75 lb. pressure—approx. 2 cu. ft. Brand new. **Stock #340 . . . . . Only $79.50**

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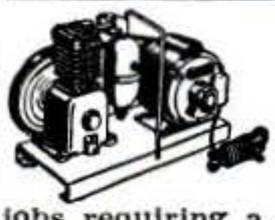
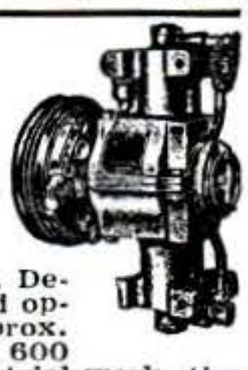


Portable **AIR COMPRESSOR**

Electric motor driven, portable spray painting unit for jobs requiring a larger quantity of material. Piston type, single cyl. air compressor has 2" bore by 1 3/4" stroke. 2.86 CFM. Max. working pressure 40 lbs. Mounted on base. Equipped with safety valve & drain cock. 1/3 HP capacitor type motor, 110 volt AC, with cord and plug. 20 ft. air hose and fittings. Ship. wt. 45 lbs. Brand new. **Stock #348 . . . . . only $42.50**

Westinghouse **AIR COMPRESSOR**



Brand new piston type, 2 cyl. compressor with automatic clutch. Westinghouse model T-1. Can be run off power takeoff or 1/2 HP motor. Delivers "oil free" air. Suggested operating pressure, 75 P.S.I. Approx. displacement 3.27 c.f.m. at 600 RPM. Ideal for spraying, industrial work, tire inflation, painting, etc. Approximate weight 23 lbs. **Stock #345 . . . . Only $22.50**

Kellog **AIR COMPRESSOR**

Kellog Model 241 air compressor. Piston type with 2" x 1 3/4" bore. Capacity of 2.8 CFM at 100 lbs. V-belt drive. 3/4" shaft. Can be run with 1/3 or 1/2 HP motor. Delivers oil free air. Max. recommended working pressure 150 lbs. **Stock #349. NEW . . . . . only $14.95**

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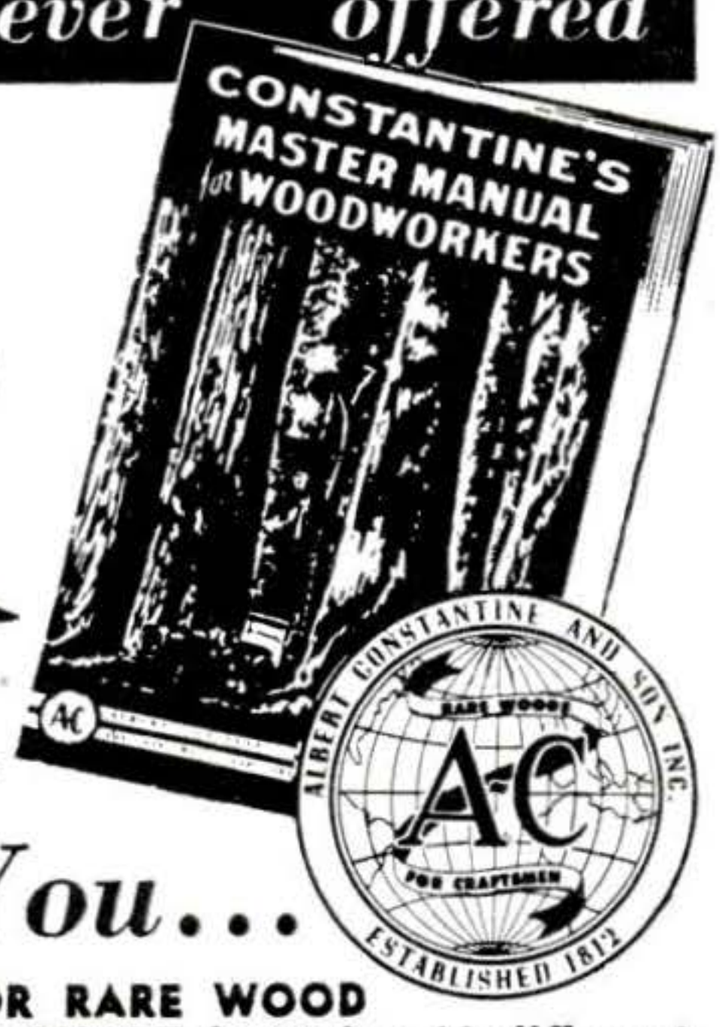

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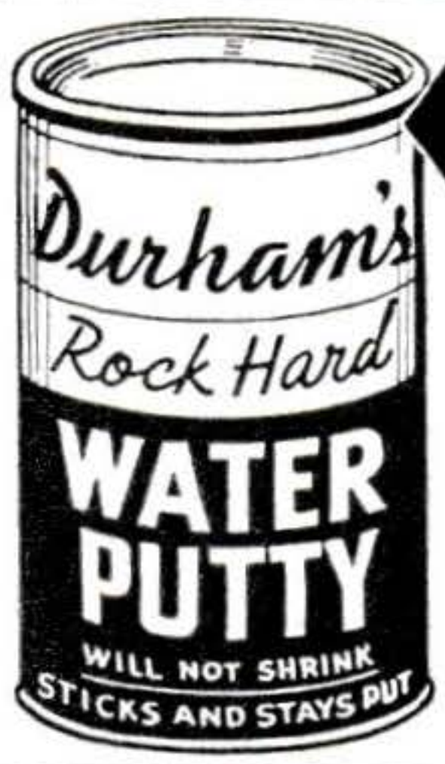
LAS-STIK MFG. CO. DEPARTMENT "D" HAMILTON, OHIO



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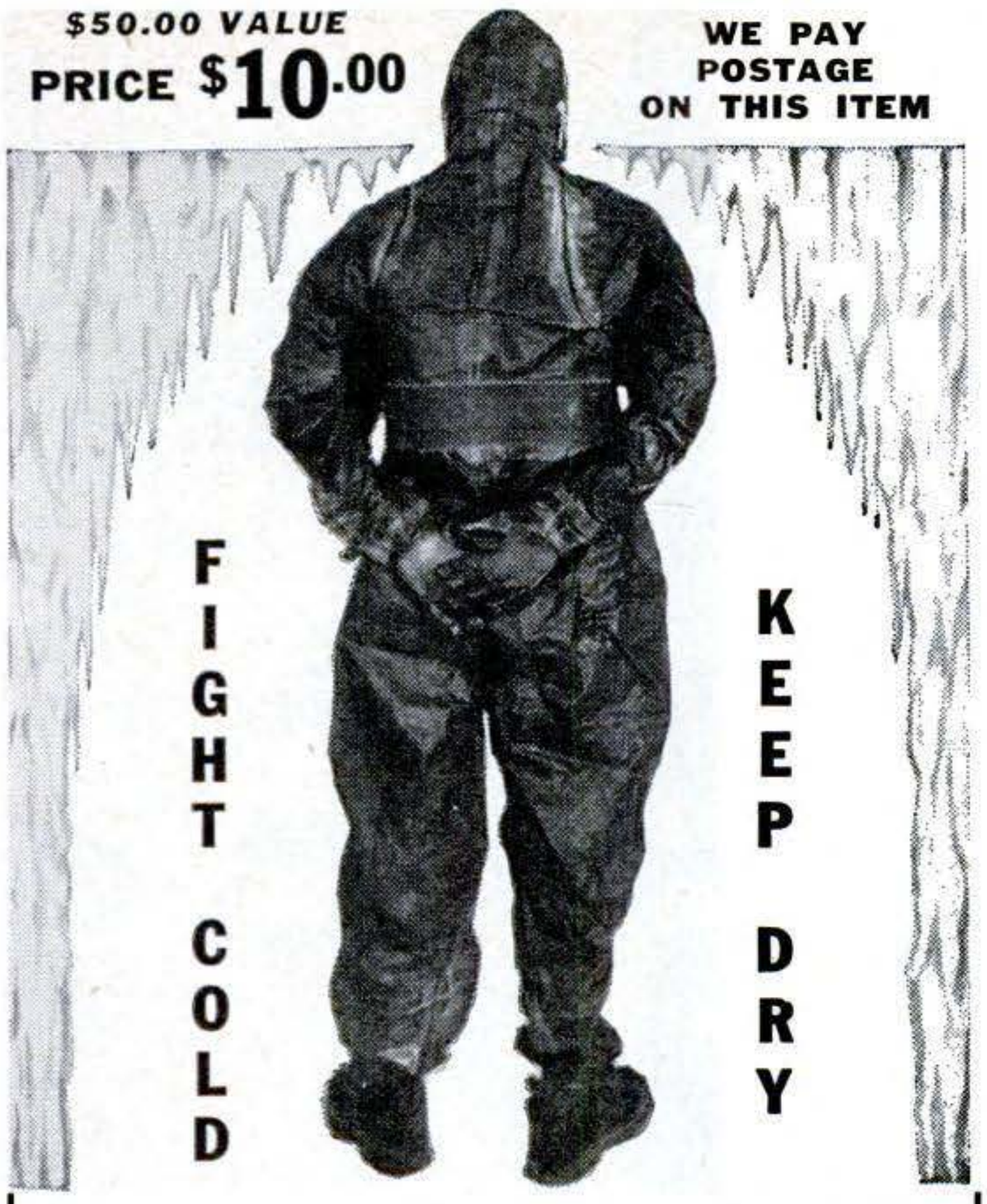

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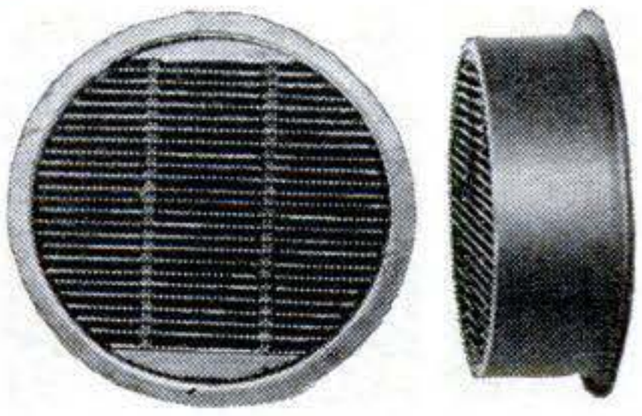

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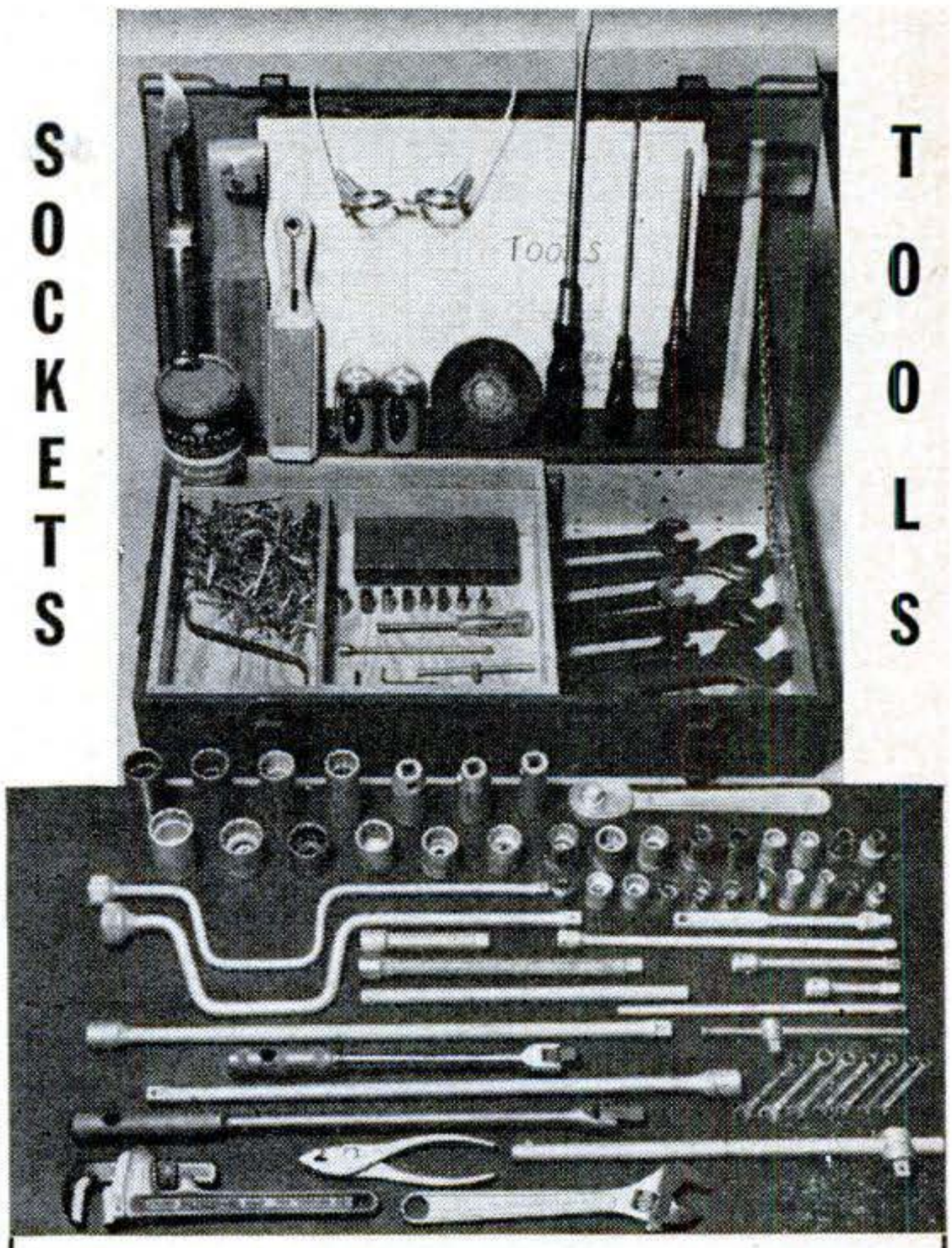
SOCKETS TOOLS



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Our purchase of over 200,000 wrenches as unused U. S. Air-force surplus makes this low price possible. All tools are NEW, all sockets are plated. They are well-known popular standard makes such as Plomb, Snap-On, etc. Set consists of over 100 tools and a husky tool chest that will last you a lifetime. This is what you get—

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7 Deep Sockets ¾" to 1⅛"
1—7/16" socket
1—½" socket
1—9/16" socket
1—⅝" socket
1—11/16" socket
1—¾" socket
1—Adapter ½" to ⅜" Drive
1—13/16" socket
1—⅞" socket
1—15/16" socket
1—1" socket
1—1-1/16" socket
1—1⅛" socket
1—1-3/16" socket
1—1¼" socket
1 Ratchet Handle
1 Speed Handle
1 18" Flex Handle
1 10" Flex Handle
1 T- Handle
1 Bar Handle
1 18" Extension
1 10" Extension
1 4" Extension
1 10" Pipe Wrench
1 10" Adjustable Wrench
1 Pair Pliers
1 Chrome Hunting Knife
1 Plastic Mallet
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1000 Cotter Keys, 25 sizes
1 Cotter Key Puller

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1—⅜" D-socket
1—7/16" D-socket
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1—½" socket
1—9/16" socket
1—9/16" D-socket
1—⅝" socket
1—11/16" socket
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1 Flex Handle
1 T-Handle
1 Bar Handle
1 10" Extension
1 4" Extension
1 2" Extension

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1—½" Socket
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1—⅝" Socket
1—11/16" Socket
1—¾" Socket
1—13/16" Socket
1—⅞" Socket
1—15/16" Socket
1—1" Socket
1—1 1/16" Socket
1—1 ⅛" Socket
2—Bar Handles
1—2" Extension
1—4" Extension
1—18" Extension
1—T Handle
1—½" Flex Handle
1—⅜" Speeder
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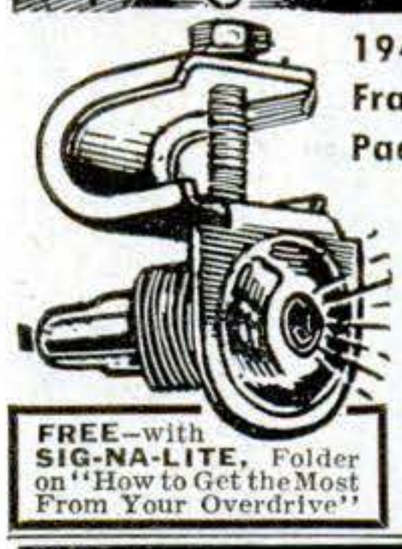

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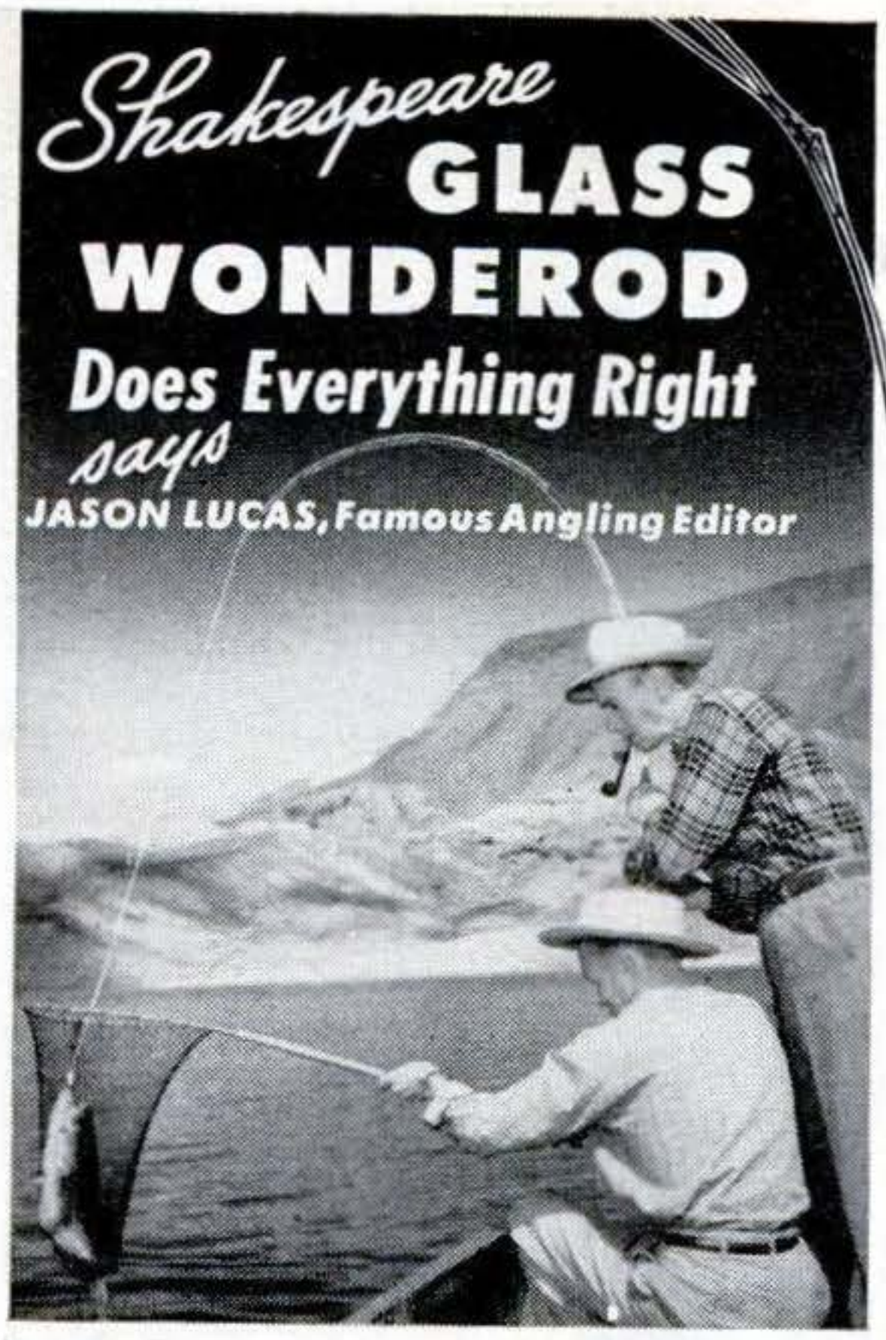

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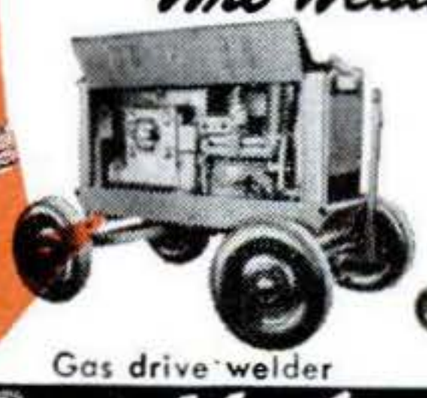

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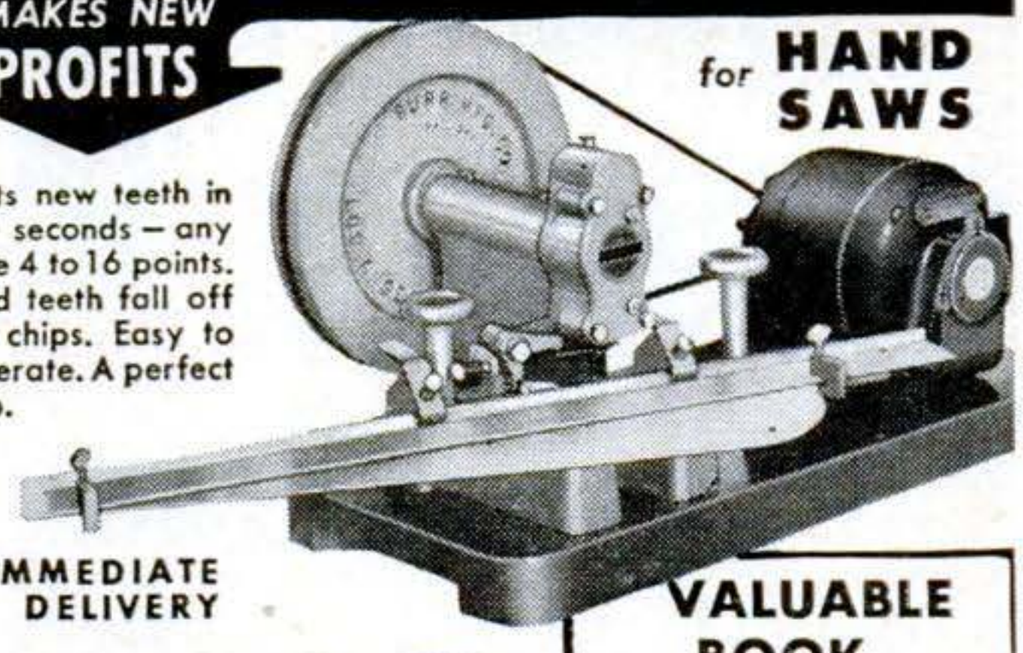

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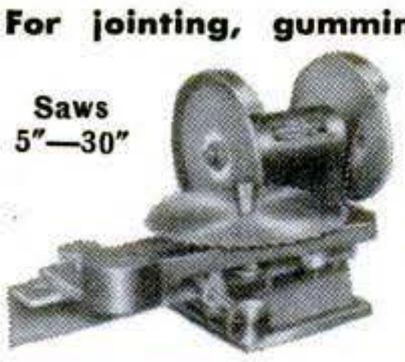

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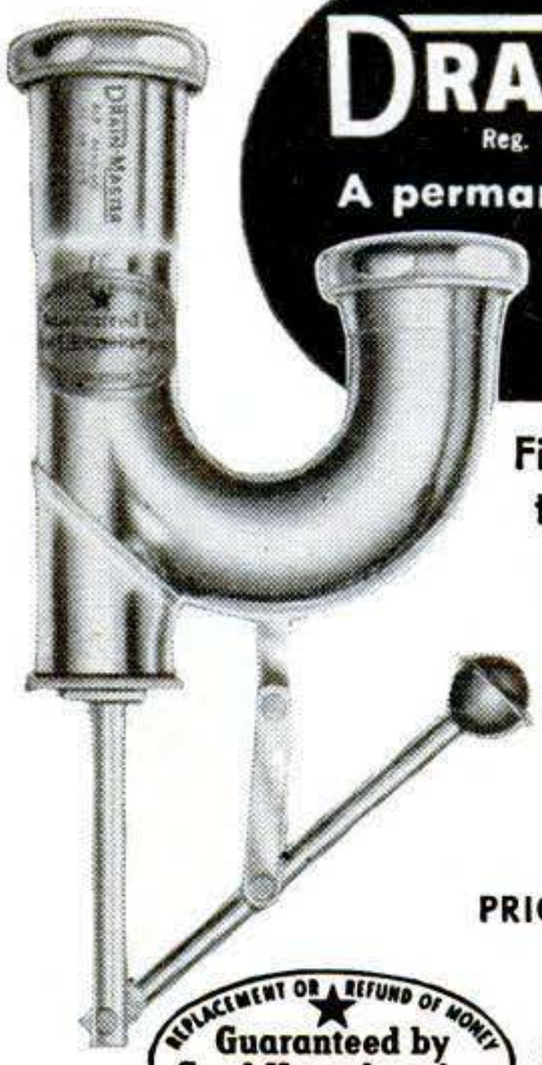

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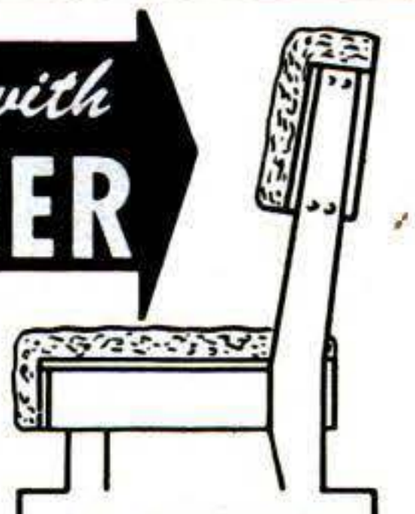

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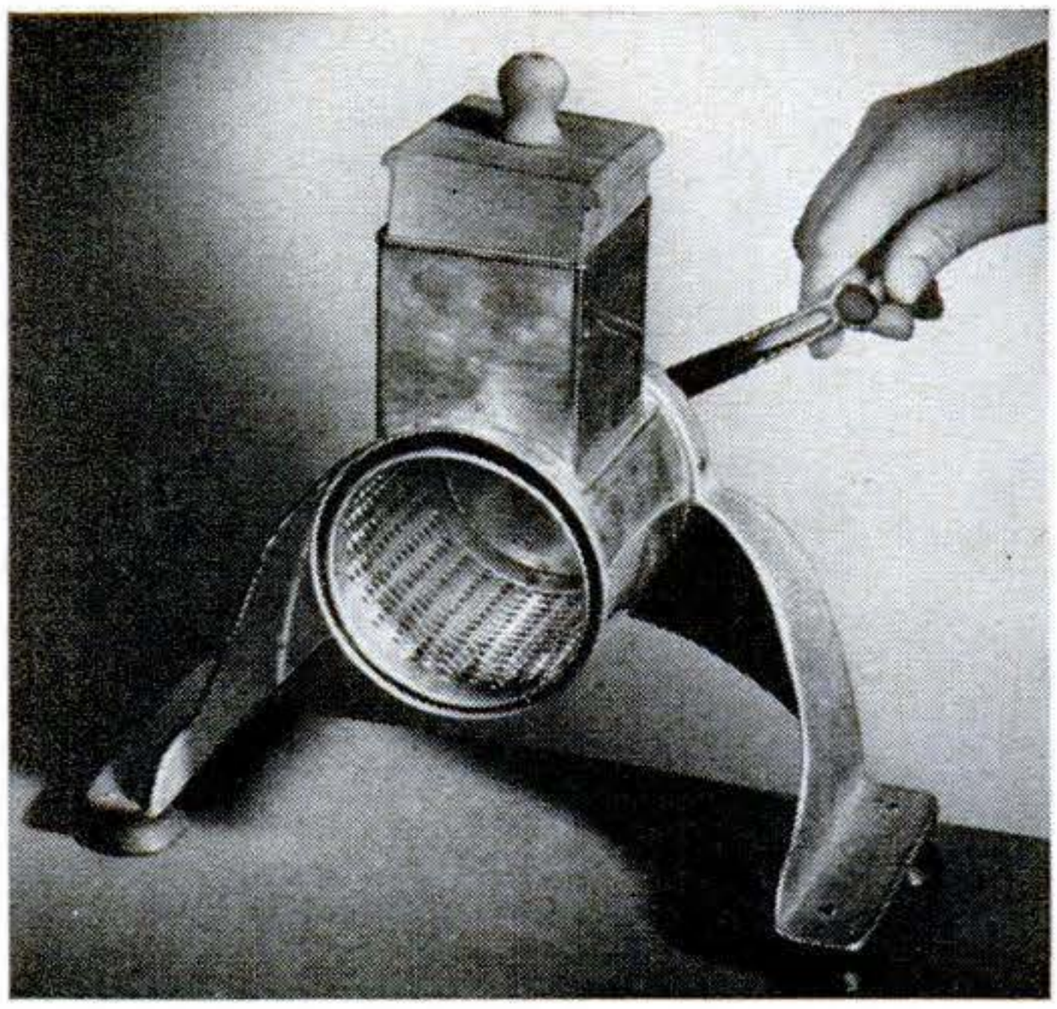
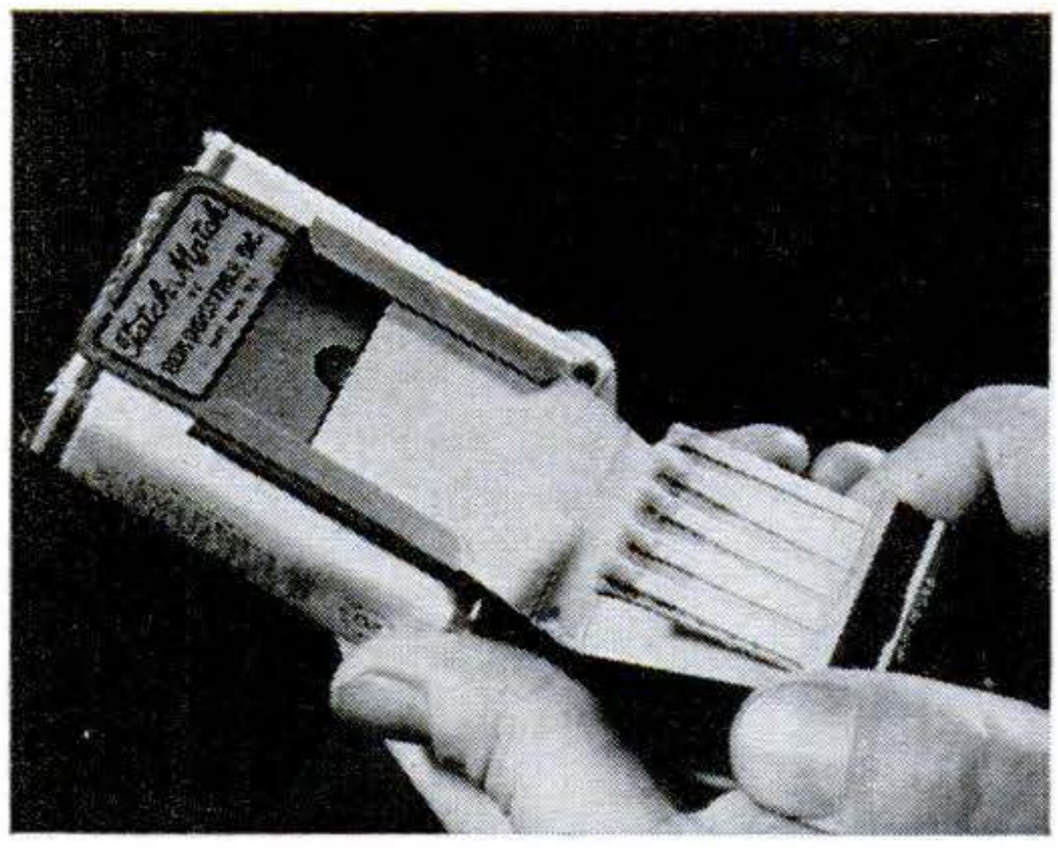


Non-Clamping Slicer. Four rubber suction cups hold this food grater, slicer, and shredder steady. A quarter turn locks the cast aluminum handle in place. The body of the grater also is cast aluminum but the square top is of tinned steel. The Hamilton Metal Products Co., of Hamilton, Ohio, prices the grater at about $7.



Match Holder Fits Pack. Made of anodized aluminum and weighing less than ½ oz., Tatch-Match ® attaches firmly to any pack of cigarettes by prongs in top and bottom. A standard book of matches then is inserted in the holder and you have both cigarettes and matches together. Maker is Geib Industries, West Bend, Wis.

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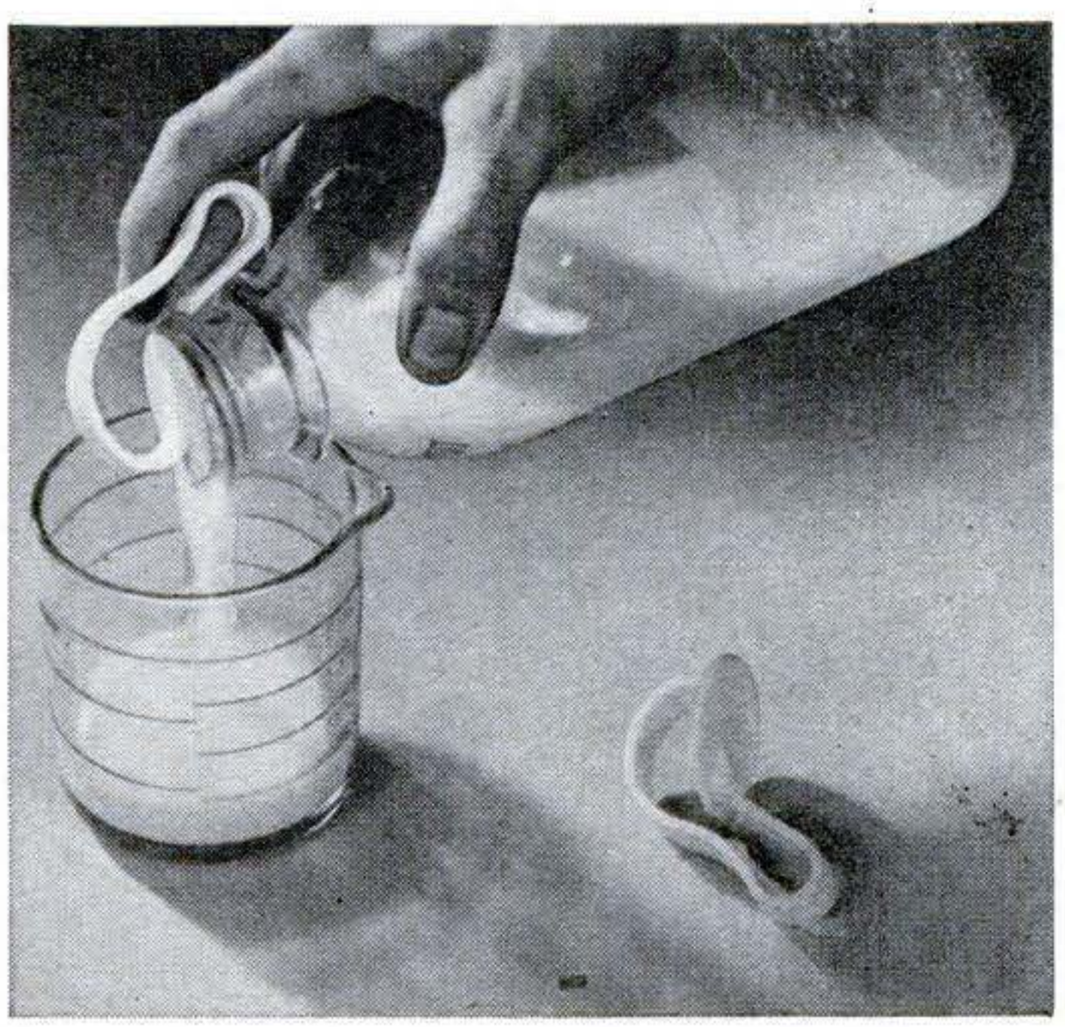
Modern Living



Bottle Cap Snaps On. Sanitop® is a new plastic cap for milk bottles. The cap, which is snapped in place, fits all standard milk bottles. Pressure on the handle raises the cap to pour out the contents of a bottle. National Plastic Products Co., of Detroit, the maker, suggests the cap also can be used on bottles of fruit juices.

Now It's Canned Linoleum. Fluid linoleum, to be painted on any floor with an ordinary brush, is offered at about $7 a gallon by Pro-Industry Products, Inc., of New York City. Called Pavinoleum ®, it is made in 10 colors. One coat is said to cover a floor at a cost of about two cents a square foot. It dries in four hours.

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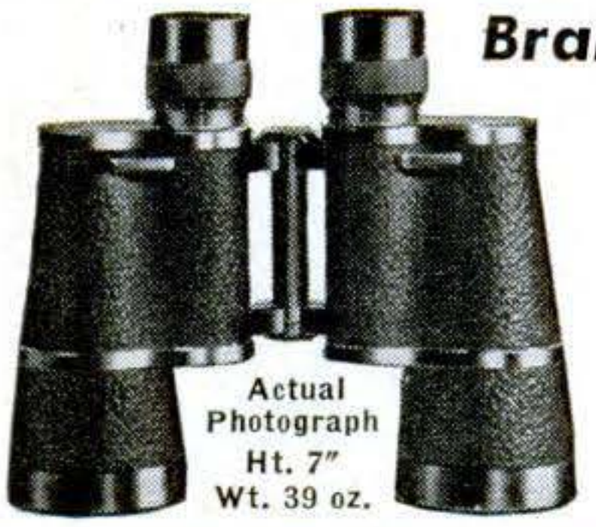

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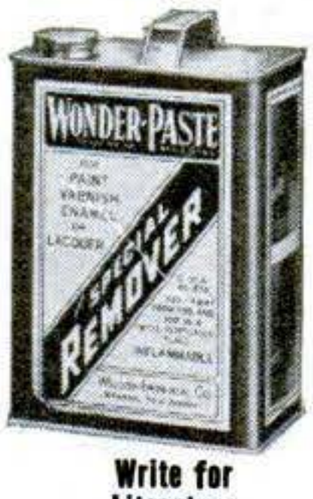

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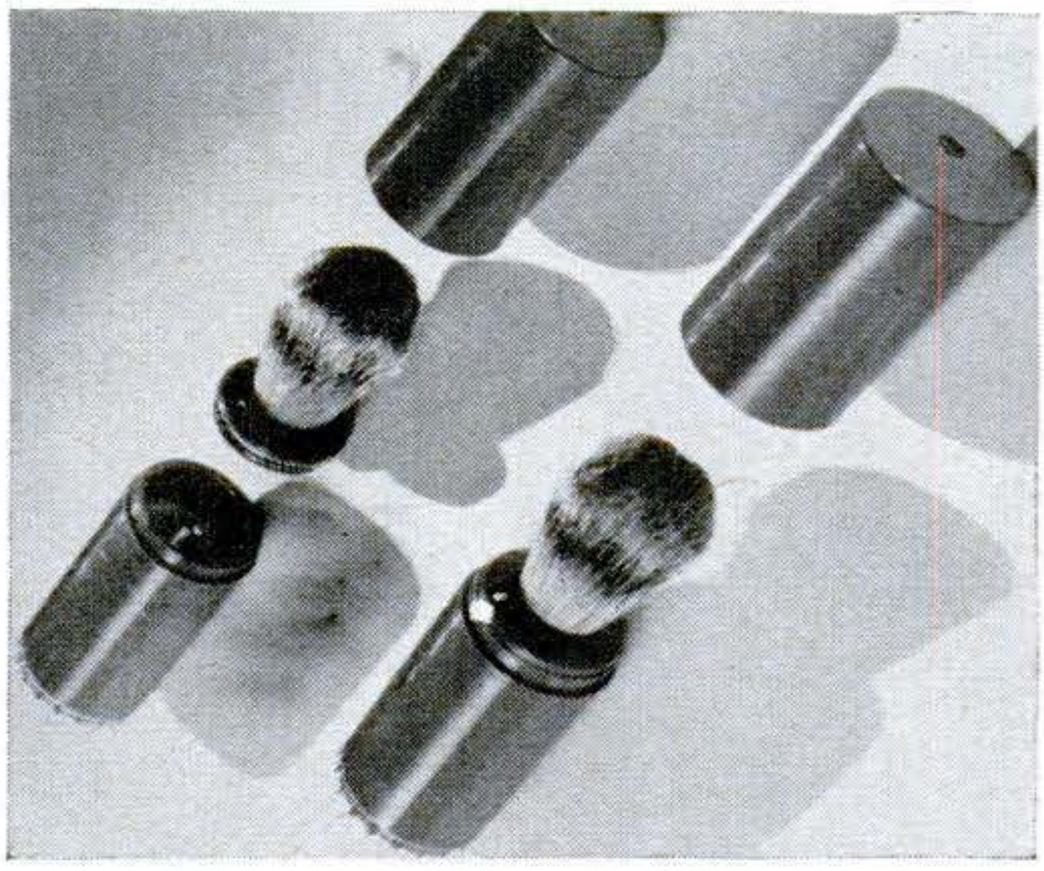
Aids to Modern Living

It Lights Up Your Phone. No more fumbling around in the dark when the telephone rings late at night. The Fone-Lite ®, made of black plastic by Stapleton Industries, Inc., Cleveland, Ohio, lights the dial with a 7½-watt bulb. Handy note pad slides out in a drawer. Priced at about $3.50, it comes with a switch and 6′ cord.



Brush Carries Own Lather. Easing the chore of shaving, this plastic fountain-type brush carries a load of shaving cream in the base. A clockwise turn of the knurled disk at the bottom causes a plunger to shove a supply of cream up through the brush. The manufacturer is the Miracle Fountain Shaving Brush Co., of Chicago.

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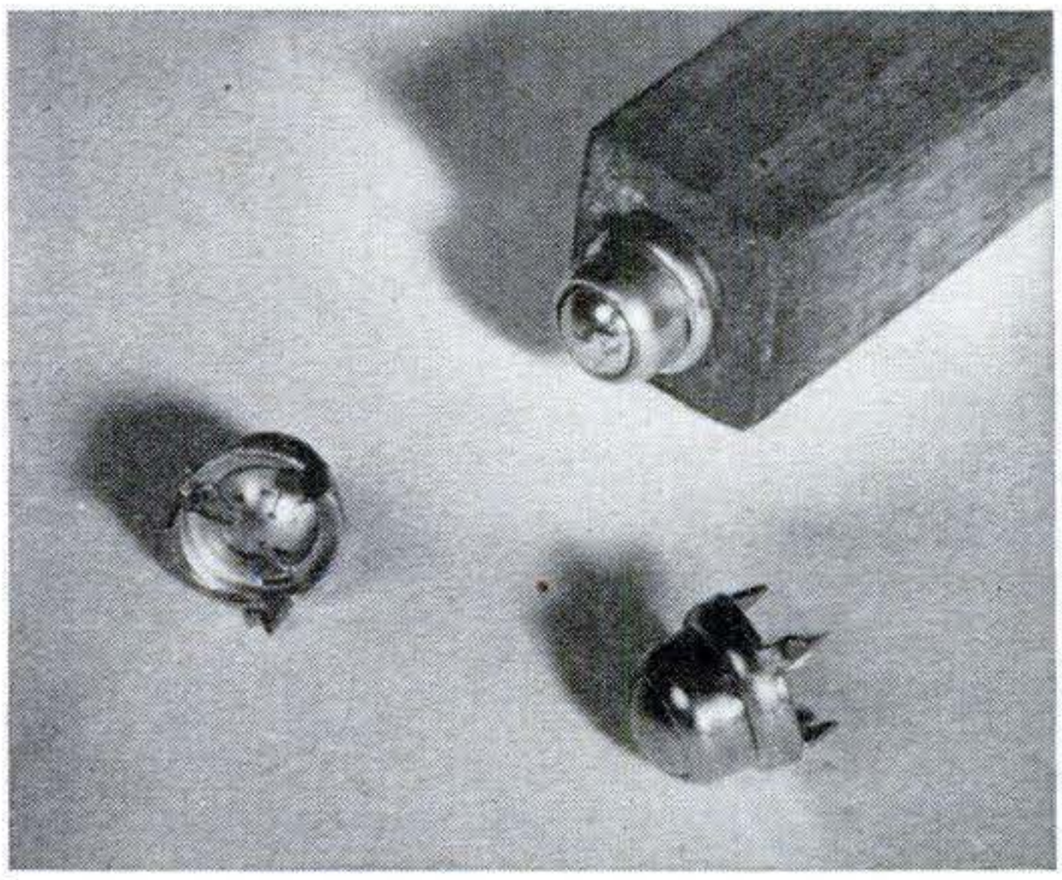
Punches Out Doughnuts. The Eject-Do-Nut ® eliminates rolling, cutting, and forming doughnuts by hand. Batter is poured in the bowl and a push of the plunger punches a doughnut out into the pan of grease. Made of heat-resistant plastic, it is priced at about $3 by the Eject-Do-Nut Sales Corp., of Los Angeles.



Caster Rolls on Ball Bearing. The Glide-A-Ball ® caster has a ball bearing in the bottom that lets a piece of furniture roll in any direction. Simple to install, you just place the three prongs against the furniture leg and hammer directly on the ball. Manufacturer is the Glide-A-Ball Caster Corp., New York City.

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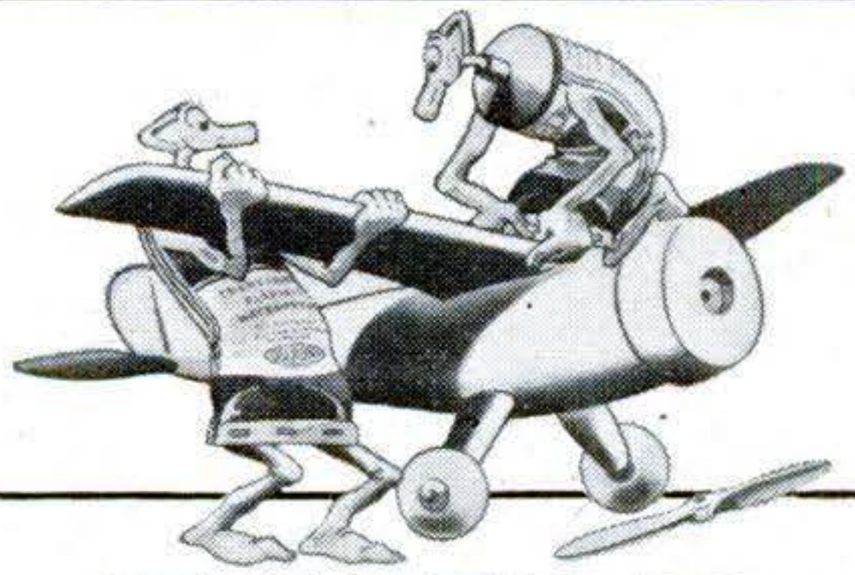

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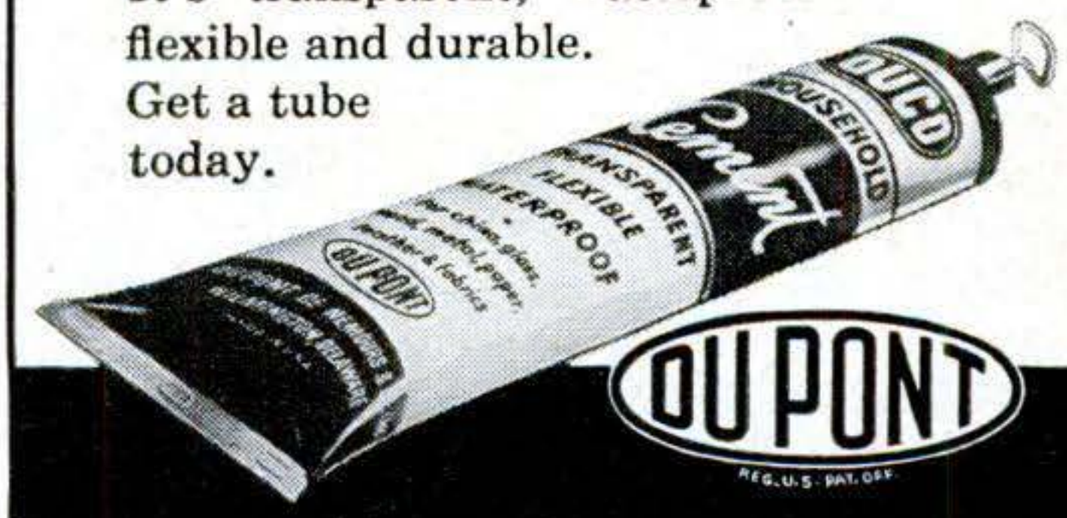

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TO: Reader
FROM: Editor

On Keeping Out of Jail

HOW do editors, especially POPULAR SCIENCE editors, stay out of jail? Two readers, within a few days, have asked that somewhat shocking query.

Their reasoning goes something like this: Your job is to publish news of how things work, what they are, and what they mean. You must describe them in words and pictures. Obviously you must, and do, discuss weapons of war. How do you know which weapons may not be explained at all, which may not even be mentioned?

("Weapons of war" are not necessarily weapons of combat. The four most valuable "weapons" of World War II, General Eisenhower says, were the C-47 airplane, the jeep, the bulldozer, and the 2½-ton truck.)

One of our questioners really is asking why we have not been jailed. He asks it rather resentfully, too, because that's where he is, in a Federal prison for a long term on an espionage charge. His trouble was that he worked for the wrong people.

We think of ourselves as employees of the American people. Through their government, they have granted us considerable freedom as editors. It would be as foolish for us to abuse it as it would be for you to abuse your freedom of speech by shouting "fire" in a crowded theater.

To the serious question, how do we know what can safely be published, we have a serious answer—a series of answers:

1. We are constantly on the alert in such potentially dangerous fields as atomic energy, aviation, ordnance, and new power sources. Over the years this has become a habit as deeply ingrained as first looking left and right before you cross a street.

2. This awareness of danger is nothing more than the habit of voluntary censorship. It worked during the war, and it works now. It places responsibility where, in a democracy, it belongs: on the official agency, military or civilian, for maintaining secrecy essential to U. S. security; on the press for maintaining an active conscience, based on judgment and integrity.

3. But you can't edit a magazine on fear. Who says you can't use that fact, print that story? More important, why do they say it? You must make your editorial conscience as clear as your patriotic conscience.

Our two most important sources of news, in war and peace, are Government and Industry. Every day they send us information by the bushel. But that doesn't mean we let Government and Industry edit POPULAR SCIENCE.

If a new plane, a new tank, or a new ship is announced, the official "release" will probably contain one-tenth of the detail required for a good, juicy PS story.

So we ask questions: What about more pictures? Is the gadget operational? What can it do? Why is it better? We ask twice as many questions as we think will be answered; we submit our finished copy and illustrations for checking before publication, because we are both accuracy-minded and security-minded.

So we come up with a better story! For evidence, you might compare the newspaper articles and illustrations of the Navy's newest carrier with the POPULAR SCIENCE lead article in our January issue, "Why the Navy Wants Supercarriers."

We were told during World War II that POPULAR SCIENCE was always one of two American magazines to reach Berlin within a week of publication. The interest of Hitler's generals was appreciated. Other generals of other nations may show a similar interest. But they will never learn more than they are supposed to know.

Fred Newman

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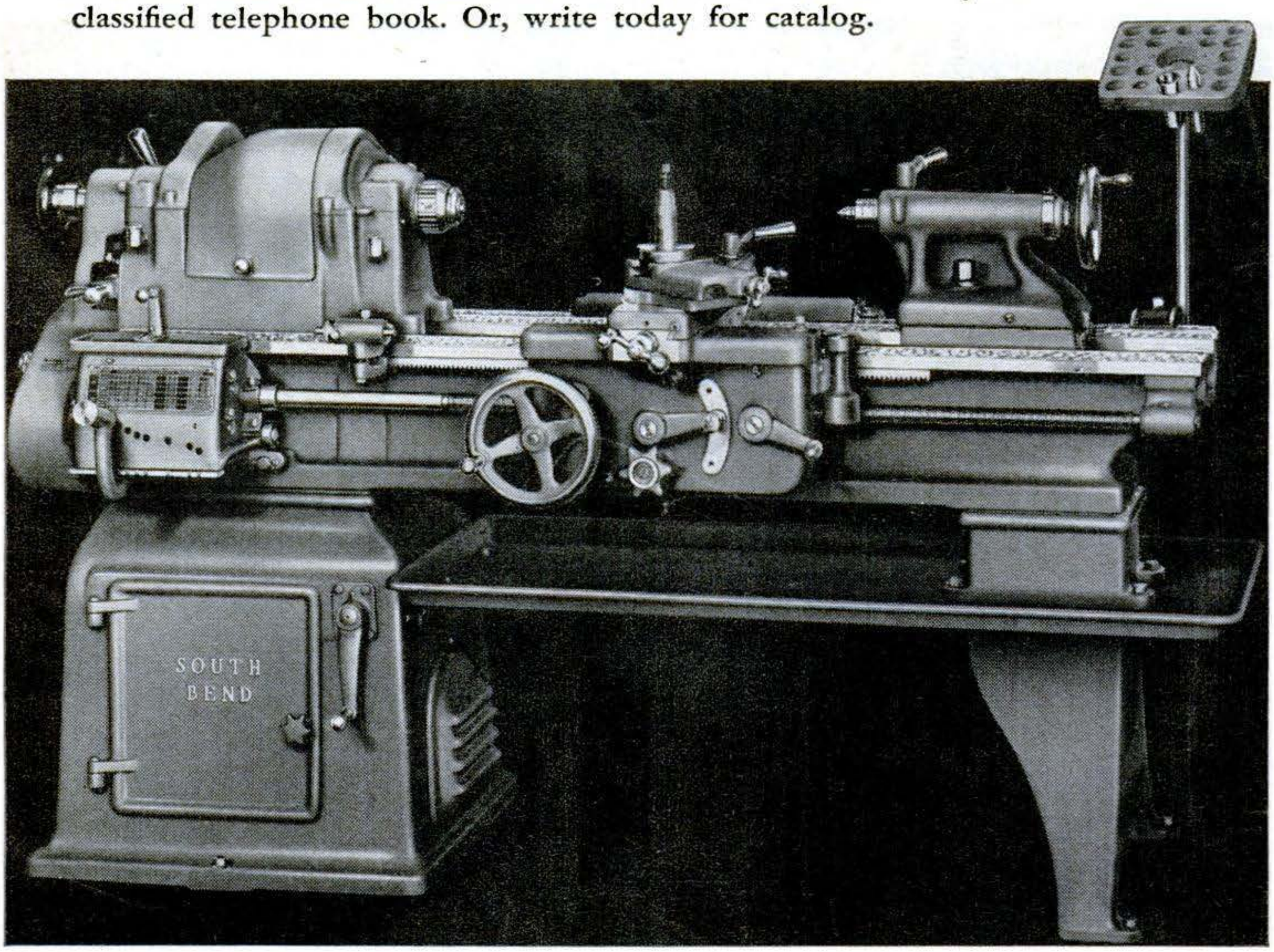

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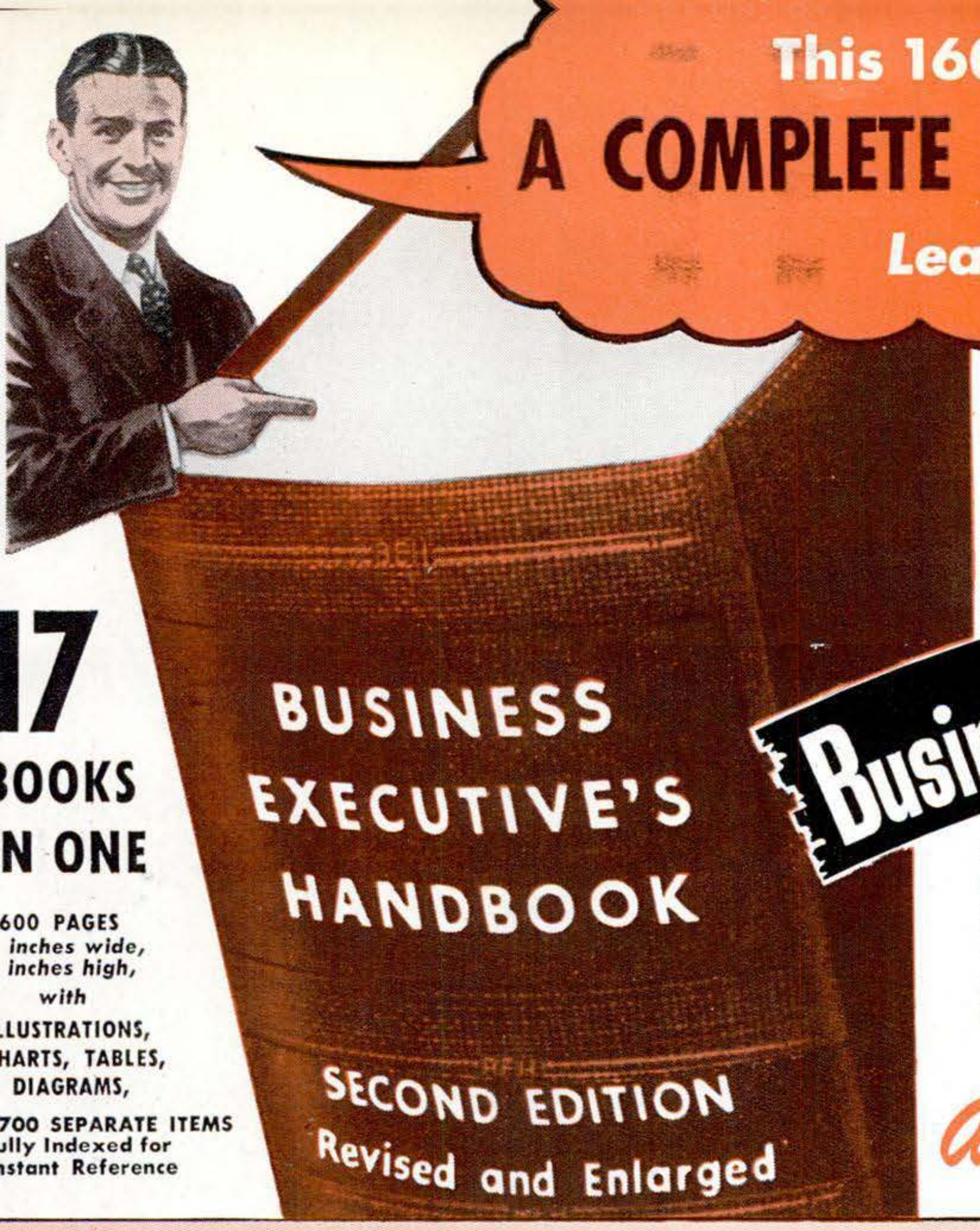

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